The Heating and Ventilating Magazine

A MONTHLY JOURNAL OF ENGINEERING PROGRESS

Vol. XIX. No. 12
$2.00 a year. 20 cents a copy

DECEMBER, 1922

Published at Cooperstown, N. Y.
New York Office, 1123 Broadway

LESKOLE

TRADE MARK REGISTERED

AT LAST

LESKOLE

RADIATOR AIR RELIEF VALVES

Without a Thermostat

LESKOLE actually does what other valves **CLAIM** to do.

LESKOLE successfully fights coal consumption at $15 to $20 a ton—no thermostat needed to prevent the heat from going up the chimney. With **LESKOLE** you need only vapor heat not 5 or 10 pounds of steam.

LESKOLE is wholly mechanical, allows perfectly free egress of **ALL** the air and only closes when steam *gets to it* then it automatically closes.

LESKOLE has a passageway to release the air **FOUR** times greater than any other valve.

List $1.75. If your Jobber cannot supply you with **LESKOLE**, we will send you prepaid, a one or two dozen carton, at the same price you would pay the jobber.

Send for **LESKOLE** booklet with testimonials which really talk.

Leskole Air Valve Company
42 Broadway, New York

A satisfied customer is the top of advertising. LESKOLE will satisfy your customer with you for having supplied it.

McKinley High School, Canton, Ohio

Architect
H. H. Hammond
Cleveland,
Ohio

Engineer
Wm. Kingsbury
Cleveland,
Ohio

Heating and Ventilation Contractors
Huffman-Wolfe Company
Columbus,
Ohio

Better ventilation for Canton's finest school building—

THE selection of Clarage Fans for the McKinley High School, in Canton, Ohio, is significant. To build the best school building that could be built it was necessary to use throughout the best equipment that could be had. Nothing was more important than venti ation—so probably nothing received greater attention than the choosing of fans.

And Clarage Multiblades were adopted! Two large Multiblade Fans located in the basement keep the entire building supplied with fresh, pure air, properly warmed in winter and cool in summer.

The many other reasons why Clarage Fans are chosen for important hospitals, schools and other buildings, are given in greater detail in a special bulletin. Ask for it.

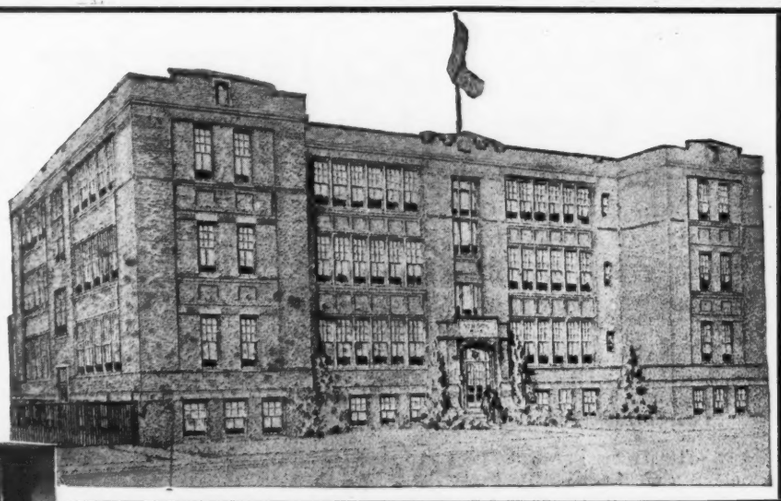
Clarage Fan Company

Main Office and Factory: Kalamazoo, Mich.

Branch Offices in Principal Cities

CLARAGE — KALAMAZOO Multiblade Fans

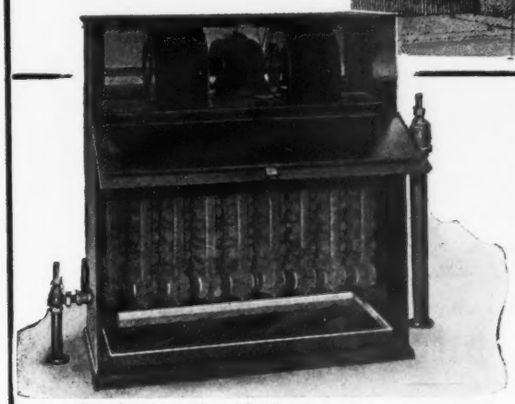
The Peerless unit is a mechanical gem. Has a radiator of the vento type, noted for efficiency; ball bearing motor requiring little attention; fan wheels of aluminum, perfect in design and balance; and a mixing damper without a peer.



Hamilton School Harrison, N. J.

Equipped with seventeen Peerless Units

Joseph W. Baker Architect



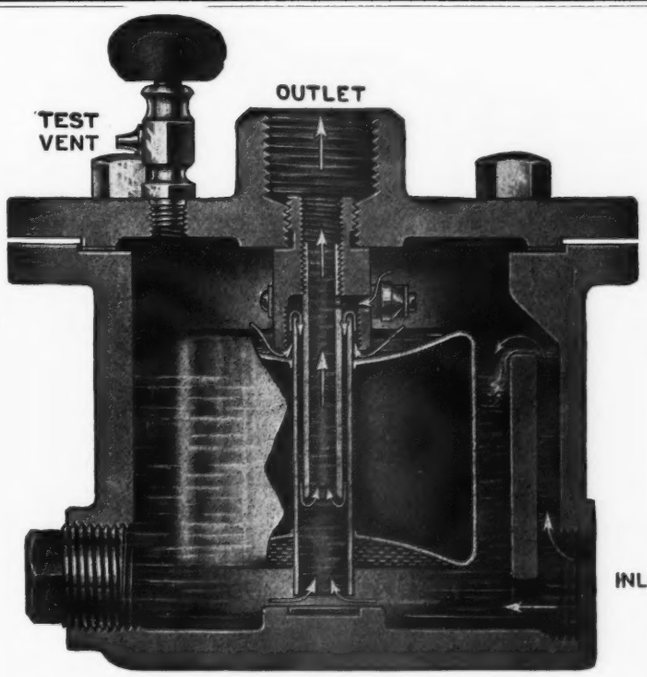
Peerless Unit with front door open showing fans and motor. Front panel and baffle removed, showing special Peerless Vento radiation and humidifying pan.

Service, Efficiency and Economy

Here is a heating and ventilating unit that combines service with efficiency and produces economy. Service in supplying pure fresh air to the required amount with perfect distribution and at the right temperature. Efficiency in the operation of the Peerless mixing damper that will by pass all or any portion of air around the radiator and economy in installation cost and the saving of fuel.

Familiarize yourself with this Peerless Unit by sending for our catalog.

PEERLESS UNIT VENTILATION CO.
437 West 16 St. New York City



MARSH

DUPLEX WATER SEAL LOW PRESSURE

BLAST TRAP

for direct or indirect coils or any location where large quantities of water are to be discharged

Operates automatically either with or without mechanical suction on return line.

No complicated parts to stick or get out of order.

No small openings to clog up with sediment or scale.

Free passage of water—rapid and steady vent of air and passes no steam.

Combined action of flotation for water and all metal thermostatic vent for air together with relief of air through water seal makes the ideal trap for heavy service.

Adjusted and tested at factory and shipped ready for installation, to work automatically from below atmosphere on up to 25 pounds steam pressure.

We Invite Correspondence

JAS. P. MARSH & CO., 118-124 South Clinton Street, Chicago

FOUNDED 1865

Manufacturers of Radiator Traps and Specialties—Automatic Air Valves and Vents Indicating and Recording Gauges

Agents for Great Britain and Ireland: Chatterton & Co., 30 Fetter Lane, E. C. 4, London
Agents for Dominion of Canada: Taylor-Forbes Co., Ltd., Guelph, Ontario

"Oil City" Boilers for Heating

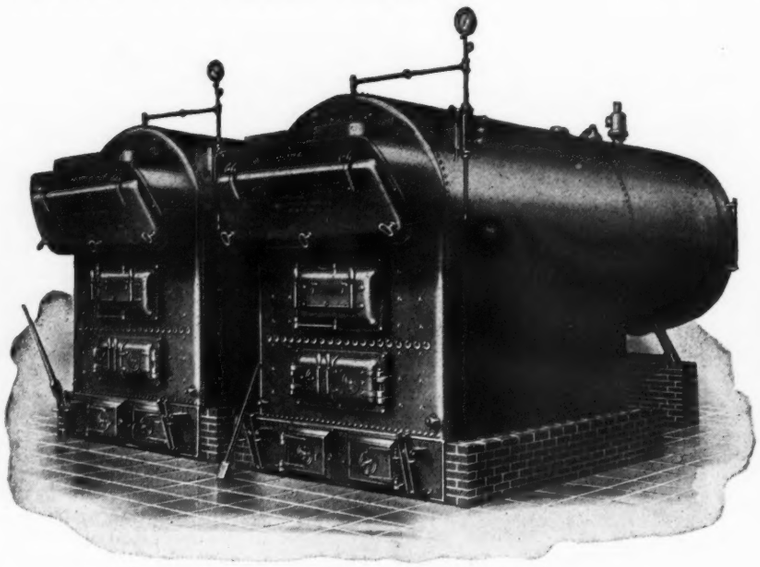
Return Tubular Portable Firebox

Will burn any kind of fuel,—hard or soft coal, oil, gas or lignite. Note use of high fire-box, giving ample combustion area to make possible the use of low-grade fuels.

Why "Oil City" Boilers are Ideal for Heating Work:

These boilers are adaptable for Apartments, Churches, Club Houses, Court Houses, Hospitals, Garages, Hotels, Office Buildings, Large Residences, Post Offices, Schools, etc., because they are Safe, Efficient, Dependable, and, being Self Contained, require little attention.

Circular H-5, H-7, H-12, H-13, gives Full Specifications, Ratings and Weights.



Built of Steel, in Accordance with the A. S. M. E. Code

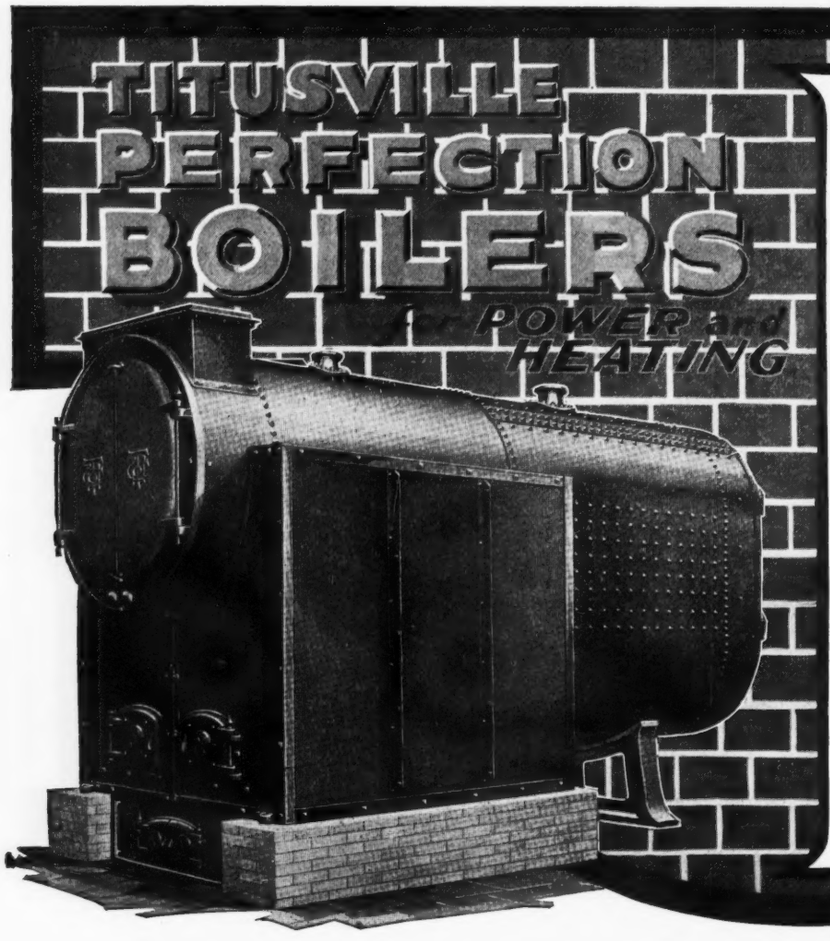
OIL CITY BOILER WORKS, OIL CITY, PA.

BRANCH OFFICES

NEW YORK, 501 Fifth Ave. CHICAGO, No. 1224 Marquette Building PITTSBURGH, House Building

REPRESENTATIVES

CLEVELAND, OHIO PHILADELPHIA, PA. ATLANTA, GA. SEATTLE, WASH. BALTIMORE, MD.
SAN FRANCISCO, CAL. ST. PAUL, MINN. BOSTON, MASS. DENVER, COL. HOUSTON, TEXAS



Titusville Boilers for Power and Heating

are built in exact accordance with A. S. M. E. Boiler Code.

ALL our boilers are built of high-grade open hearth steel, properly riveted and thoroughly inspected during construction—tested and guaranteed to be perfect in every way before shipment.

The fire-box of the Perfection Boiler is lined with special fire-brick and made air-tight by the steel casing.

Specifications and complete data will be found in our new catalog, 81, a copy of which we will gladly send on request.

Titusville Iron Works Co.

TITUSVILLE, PENNA.

SALES OFFICES

NEW YORK 152 W. 42nd St. CHICAGO 53 W. Jackson Blvd.
PITTSBURGH Farmers Bank Bldg. BUFFALO Marine Trust Bldg.
DETROIT Peter Smith Bldg. WASHINGTON Woodward Bldg.

A Steel, "Hand Tailored" Boiler

Hydraulic Riveter at work on a Kewanee Boiler

Each and every

Kewanee Boiler is a "hand tailored" boiler. Each boiler is cut out individually, from accurate steel patterns, and each rivet is individually driven with tremendous hydraulic pressure.

Each piece of

steel plate that goes into a Kewanee Boiler is carefully selected. And after the boiler is built it is given a pressure test far in excess of any pressure at which it will ever be operated.

The result of all

this is unquestioned strength and durability. ***We don't know how long Kewanee Boilers will last—we have only been making them 30 years.***

KEWANEE BOILER COMPANY
KEWANEE, ILLINOIS

Steel Heating Boilers, Radiators, Tanks, Water Heating Garbage Burners

BRANCHES:

CHICAGO	Washington and Market Sts.	MILWAUKEE	835 Merch. & Mfrs. Bldg.
NEW YORK	47 W. 42nd St.	PITTSBURGH	945 Oliver Bldg.
DES MOINES	315 Hubbell Bldg.	DENVER	514 Boston Bldg.
KANSAS CITY	2014 Wyandotte St.	DALLAS	809 Southwestern Life Bldg.
INDIANAPOLIS	509-10 Occidental Bldg.	DETROIT	1772 Lafayette Blvd.
ST. LOUIS	1212 Chemical Bldg.	TOLEDO	1121-22 Nicholas Bldg.
MINNEAPOLIS	708 Builders Exchange	CLEVELAND	706 Rose Bldg.
COLUMBUS	808 First Nat'l Bank Bldg.	ATLANTA	1524-25 Candler Bldg.
SALT LAKE CITY	204 Dooly Bldg.	SAN FRANCISCO	72 Fremont St.

CANADIAN REPRESENTATIVES—The Dominion Radiator Co., Ltd.

Toronto, Ont., Montreal Que., Winnipeg, Man.
Hamilton, Ont., St. John, N. B., Calgary, Alta.

KEWANEE

IMICO HEATING BOILERS

For Water and Steam

Various Sizes

Imico Vacuum Heating System

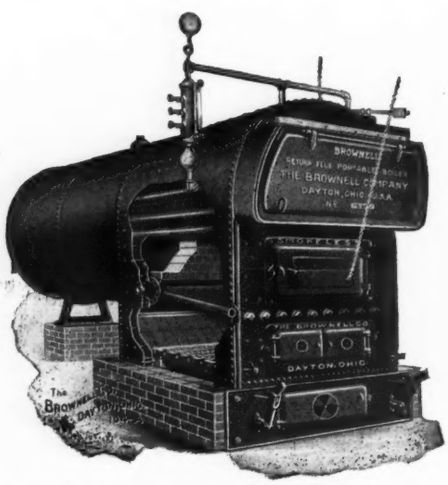
Write For Catalogue

Manufactured by

ILLINOIS MALLEABLE IRON CO. **Chicago, Ill.**

BROWNELL

Do you know—



Brownell Return Flue Portable Boiler—Smokeless Type

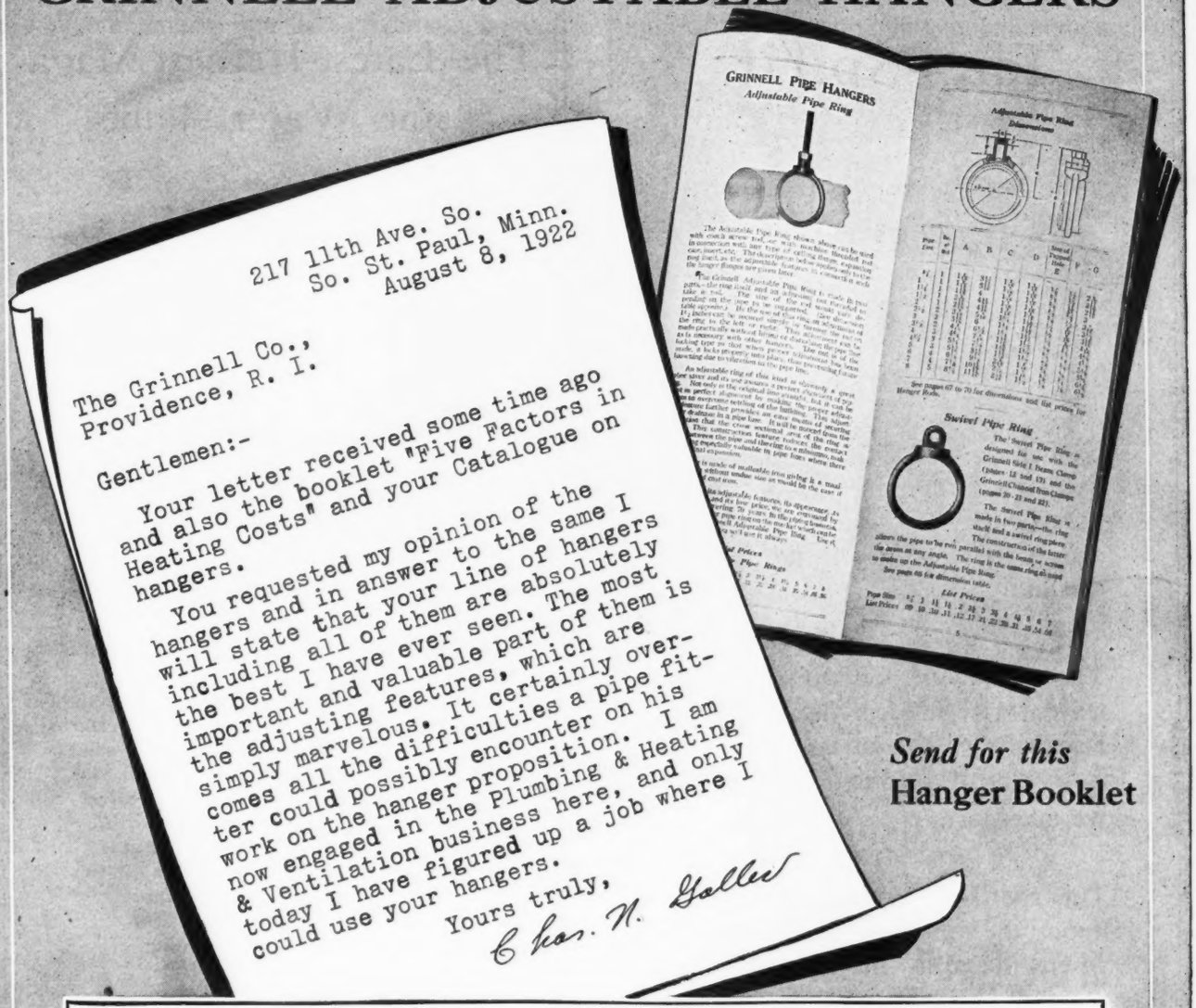
The A. S. M. E. Boiler Code is considered one of the best codes today, but if you should buy an A. S. M. E. Code Boiler are you sure of a satisfactory boiler? ***You are not.*** Boilers can be built according to the A. S. M. E. Boiler Code, or almost any other code for that matter, and still be radically different in design. Perhaps one is good and the other very bad. The Code limits various details, prohibits others, but allows many designs. A great deal is put up to the boiler manufacturer. A Brownell Boiler is backed by 67 years of boiler experience and inspected by one of the oldest inspection and insurance companies. You take no chance in buying a Brownell A. S. M. E. Code boiler. There is a difference. Let our representative show you.

Bulletin B 6-A

THE BROWNELL COMPANY
DAYTON, OHIO, U. S. A.
Established 1855

BOILERS

GRINNELL ADJUSTABLE HANGERS


217 11th Ave. So.
So. St. Paul, Minn.
August 8, 1922
The Grinnell Co.,
Providence, R. I.
Gentlemen:-
Your letter received some time ago and also the booklet "Five Factors in Heating Costs" and your Catalogue on hangers.
You requested my opinion of the hangers and in answer to the same I will state that your line of hangers including all of them are absolutely the best I have ever seen. The most important and valuable part of them is the adjusting features, which are simply marvelous. It certainly overcomes all the difficulties a pipe fitter could possibly encounter on his work on the hanger proposition. I am now engaged in the Plumbing & Heating & Ventilation business here, and only today I have figured up a job where I could use your hangers.
Yours truly,
Chas. N. Galles
GRINNELL PIPE HANGERS
Adjustable Pipe Ring
Swivel Pipe Ring

***Send for this* Hanger Booklet**

"the adjusting features . . . are simply marvelous"

—writes Mr. Charles N. Galles, plumbing and heating contractor of South Saint Paul, Minn., in commenting on Grinnell Adjustable Pipe Hangers. And he adds—but read his letter yourself. It's quoted above.

Grinnell Pipe Hangers are the only pipe hangers that are readily adjustable *after* installation. And, important though this feature is both to ease of installation and to the economical maintenance of the piping system, it is hardly more important than the widely diversified designs in which the hangers are made. These designs are based on our forty years' experience as America's leading automatic sprinkler system contractor, and they overcome every conceivable pipe-hanging problem.

Until recently we made these hangers only for our own use, but increased manufacturing facilities now enable us to supply them to other contractors who specialize on high quality work.

The complete line is shown in our Pipe Hanger Catalog, which also contains many pages of carefully compiled data valuable to every architect, engineer, and contractor. We will gladly forward a copy of this handbook free, on request.

Address Grinnell Company, Inc., 280 West Exchange Street, Providence, R. I.

GRINNELL COMPANY

Automatic Sprinkler Systems | Steam & Hot Water Heating Equipment | Humidifying and Drying Equipment | Fittings, Hangers and Valves | Pipe Bending, Welding, etc. | Power and Process Piping

If it's Industrial Piping, take it up with us

The Spirit of Christmas

Business may be a coldly practical proposition, but there come times when the Human element proves that men's hearts beat warmly.

The Spirit of Christmas has temporarily closed the Order Book, drawn the curtain on the Activities of Business in which we take part.

The spotlight is now directed upon "the other side of Life"—where the profit motive is supplanted by Friendship and Goodwill.

It is in this spirit that we extend to you warm, whole-hearted Good Wishes—hopes for your Health, Happiness and Prosperity thruout the New Year.

INTERNATIONAL HEATER COMPANY

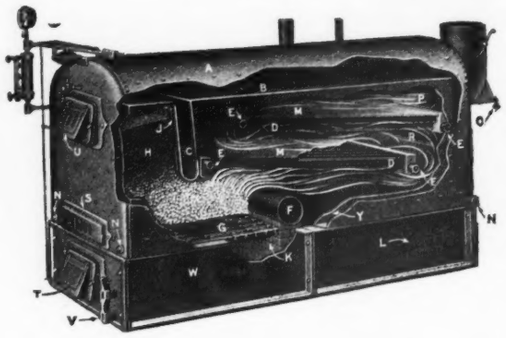
UTICA, N. Y.

BRANCHES:

New York Chicago Cleveland Nashua, N. H.

INVESTIGATE

The Latest Herbert Magazine Water Tube Smokeless Boiler



These are a few of the Features

(1) No smoke after the fire is thoroughly started. (2) No Flues to clean. (3) Burns Soft Coal Successfully. (4) Carries steam from twelve to fifteen hours with one fire. (5) Has downdraft and direct draft to suit weather conditions. (6) It is all shell surface, which means economy. (7) Can be set in brick, which gives one more return of the hot gases. (8) No Brick Arches or other flimsy devices. (9) Natural draft and the highest economy. (10) Built in steam sizes from 500 square feet to 25,000 square feet

HERBERT

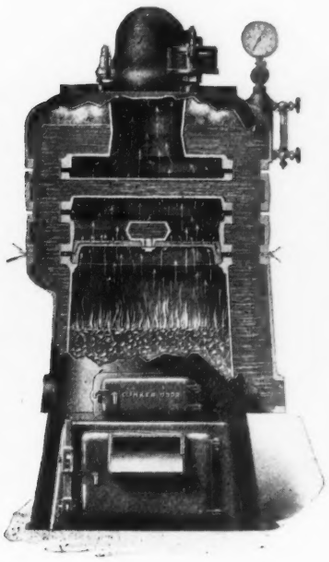
Has combined the downdraft feature with the direct draft and dispensed with the objectionable parts of both.

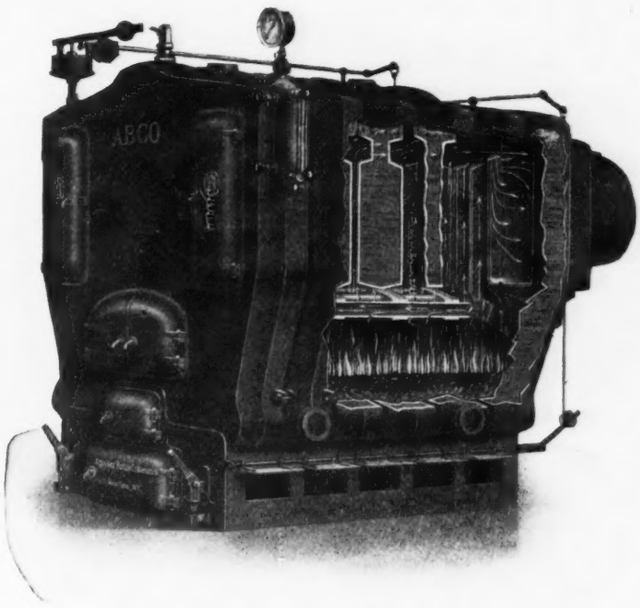
HERBERT BOILER COMPANY

Root & LaSalle Sts.

Chicago, Illinois

BOILER PRECISION





ABCO BOILERS ARE SUITABLE FOR ANY JOB

Whether for large or small homes, apartment houses, office buildings, libraries or factories the words ABCO BOILERS in your specifications will mean that you are getting BOILER PRECISION—the right boiler for the job with an assurance of efficiency and economy.

Consider these features—features that produce results whether it is in a small house or large building that the ABCO boiler is installed.

The heating surfaces of the ABCO BOILERS are 75% direct which remains efficient without cleaning.

Abco Boilers will burn anthracite and bituminous coal and coke and are rated according to the heating surface contained in the boiler. Coal capacity provides for the operation of eight hour firing periods and numerous air inlets in base afford a rapid rate of combustion if desired.

The smokless feature of the Abco Boilers is designed as a part of the boiler and not an attached device. Free oxygen is distributed throughout the entire area of the grate surface above the fire in fine streams and not introduced in a large volume at one given point.

Abco Boilers are fully described in a new catalog just out. To have it will mean a contribution to your knowledge of heating practice. Your name and address will bring it.

ADVANCE BOILER CORPORATION
Grand Central Terminal, New York

We can make immediate shipments.

ABCO BOILERS

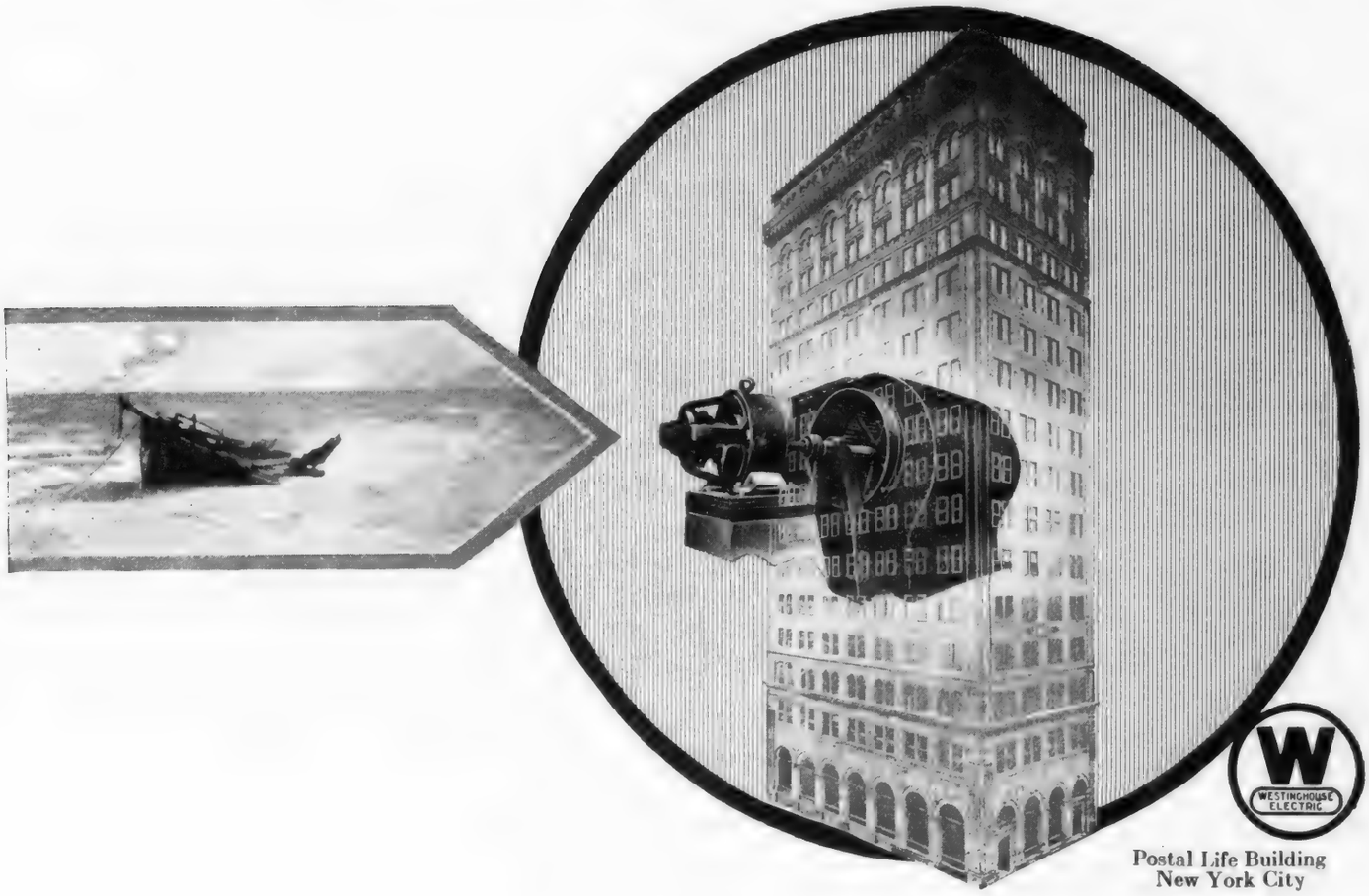
Prestige

is the result of hard work. The ability of Westinghouse motors to stand up under severe service conditions has largely contributed to Westinghouse prestige.

Years of patient study, experiment and the skill of expert electrical engineers have developed a complete line of Westinghouse Motors and Controllers for Heating and Ventilating service. These motors and controllers have won world-wide reputation for successful performance.

The speed and power of Westinghouse Heating and Ventilating Motors have been developed specifically for blower and fan applications. Sturdy construction enables these motors to withstand continuous service

Westinghouse



Postal Life Building
New York City

and severe service with low maintenance costs.

A few recent New York City installations of Westinghouse Electrical Heating and Ventilating Equipment are the Pershing Square Building, Federal Reserve Bank, Bowery Savings Bank, New York Cotton Exchange, Princeton Club, National Bank of Commerce, Manhattan College, Third Church of Christ, Scientist, and the Intervale Telephone Building.

Further particulars and Motor Application Circular 7193 will be sent upon request to our nearest district office.

Westinghouse Electric and Manufacturing Company
EAST PITTSBURGH PENNSYLVANIA

Westinghouse

Permanency

FOR a given piping system you select joints only once. Once these joints are installed you want perfect service and no excavating for repairs or packing. The installation, too, must be easy and simple. In short, what you demand of expansion joints is efficiency, at the least cost and once installed no further attention needed. This demand

Badger Self Equalizing Expansion Joints

successfully meets.

Being made of the best quality lake copper they are extra durable. Scientifically designed, having deep corrugations and with the aid of equalizing rings conforming to the shape of these corrugations, they control expansion in the mots efficient manner.

The Badger Self Equalizing Expansion Joint can be installed in a pipe line as easily as a flanged fitting; they have no complicated parts, they are compact and are hydraulically tested before shipment.

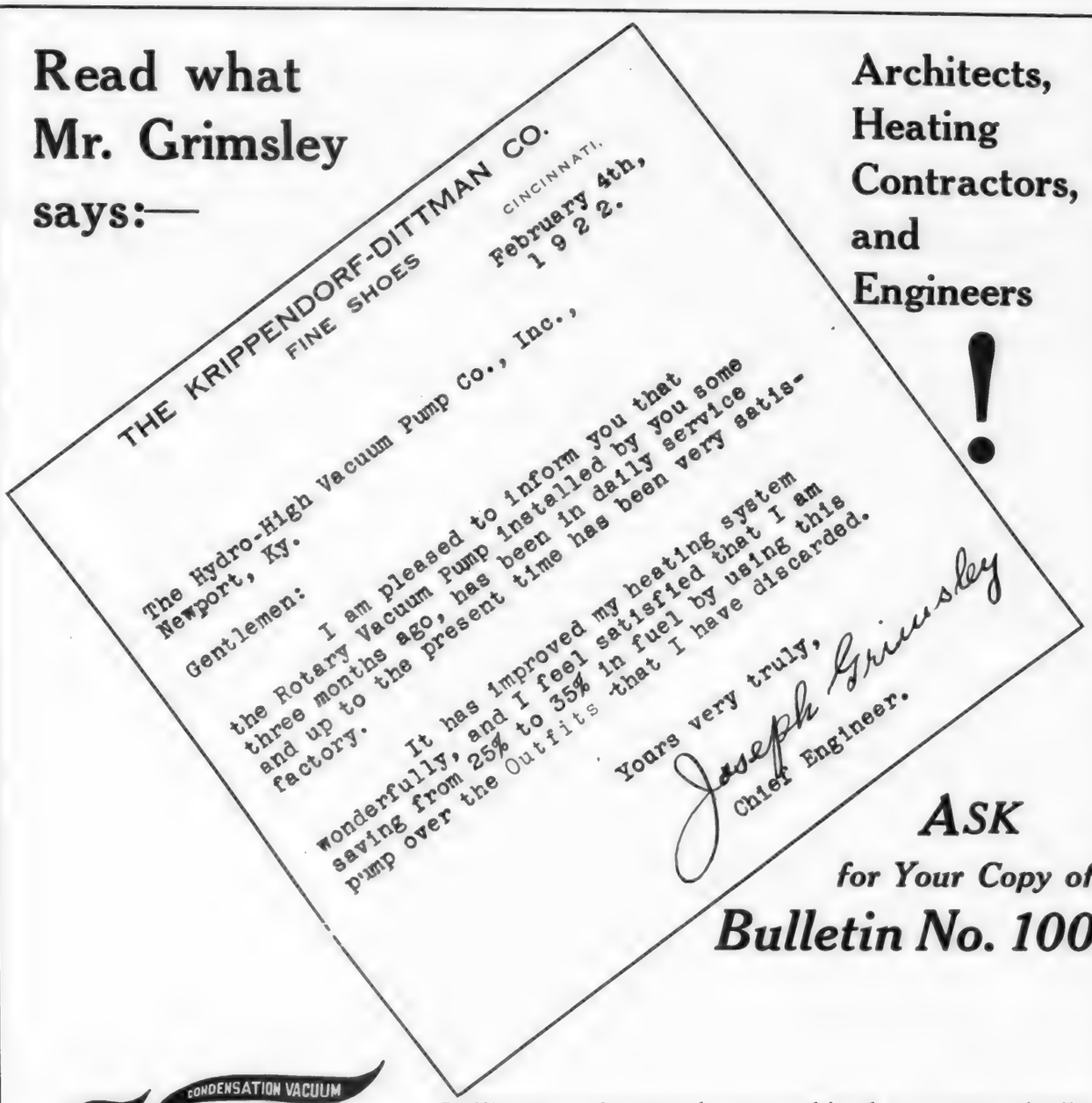
One important feature of the Badger Self Equalizing Expansion Joints that impresses Engineers is that the joints occupy little more space than the pipe in the trench. This makes an 'ease of installation' desired by all Engineers.

Send for our book of complete information

E. B. BADGER & SONS COMPANY

75 Pitts Street **Boston, Mass.**

Read what Mr. Grimsley says:—



THE KRIPPENDORF-DITTMAN CO.
FINE SHOES
CINCINNATI,
February 4th, 1922.

The Hydro-High Vacuum Pump Co., Inc.,
Newport, Ky.

Gentlemen:

I am pleased to inform you that the Rotary Vacuum Pump installed by you some three months ago, has been in daily service and up to the present time has been very satisfactory.

It has improved my heating system wonderfully, and I feel satisfied that I am saving from 25% to 35% in fuel by using this pump over the Outfits that I have discarded.

Yours very truly,
Joseph Grimsley
Chief Engineer.

Architects, Heating Contractors, and Engineers !

ASK for Your Copy of Bulletin No. 100

CONDENSATION VACUUM
Hydro PUMPS

Compactly built.
Occupies less space and weighs only one-half as much as any other vacuum pump.
Shipped as one assembled unit.

It illustrates how we have combined an automatically controlled centrifugal water pump, and vacuum-pump impeller.
Patented Hydro features make it the *only* pump that reaches the absolute barometric pressure.
Performs remarkably, with condensate at 190° F.
Valveless. Its automatic control is positive in operation.
SKF self-aligning ball bearings. Wagner motor.
Fully five years ahead of the times in design and construction.

REPRESENTATIVES—Get Our Special Offer!

The Hydro-High Vacuum Pump Co
INCORPORATED

"A Size for Every Requirement"

NEWPORT, KENTUCKY

UNION

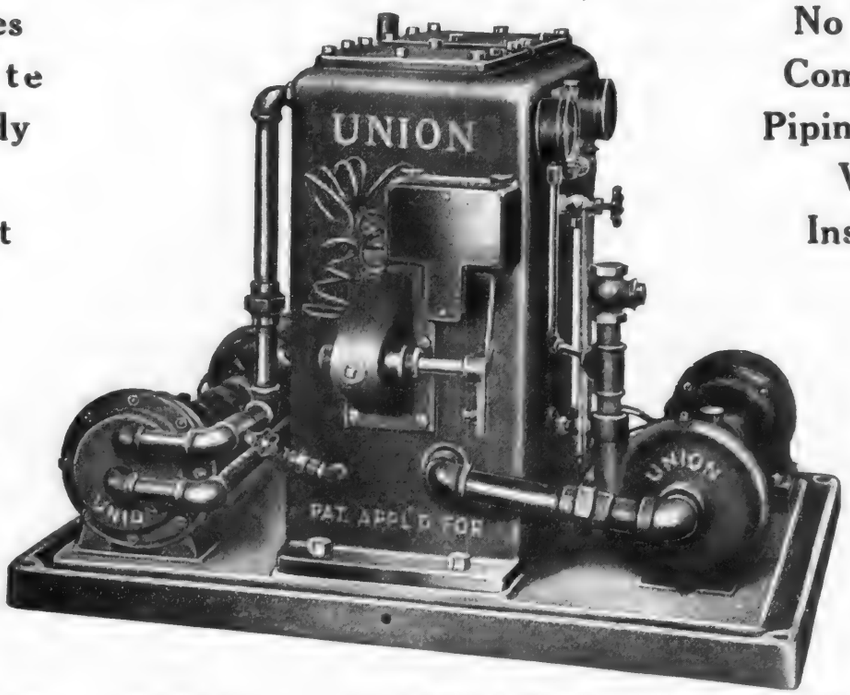
CENTRIFUGAL VACUUM PUMP AND BOILER FEED SET

You have always known
someone would do it—and hoped
it would be an old reliable
pump manufacturer
so it would be

Simple — Complete — Reasonably Priced

Here It Is—Assembled From Standard Units
The Way You Have Wanted It

It Comes Complete All Ready To Connect



No Special Complicated Piping to Add When Installing

Vacuum Pump For Any Capacity

Boiler Feeder For Any Pressure

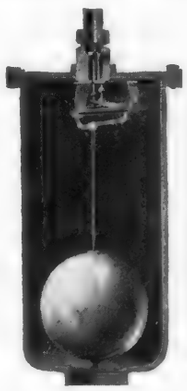
BUILT — SOLD — GUARANTEED STRICTLY
ON A VACUUM PUMP BASIS BY

UNION STEAM PUMP CO.
BATTLE CREEK, MICH., U. S. A.

Here's the Trane Duplex Unit

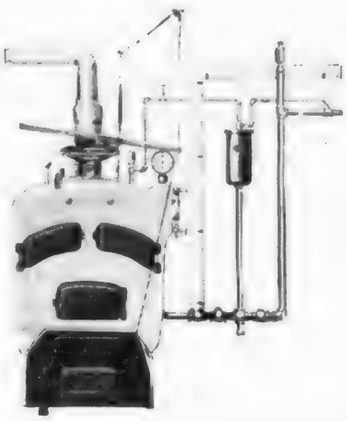
TRANE HEATING SPECIALTIES

"Trane's little Condensation Pump"



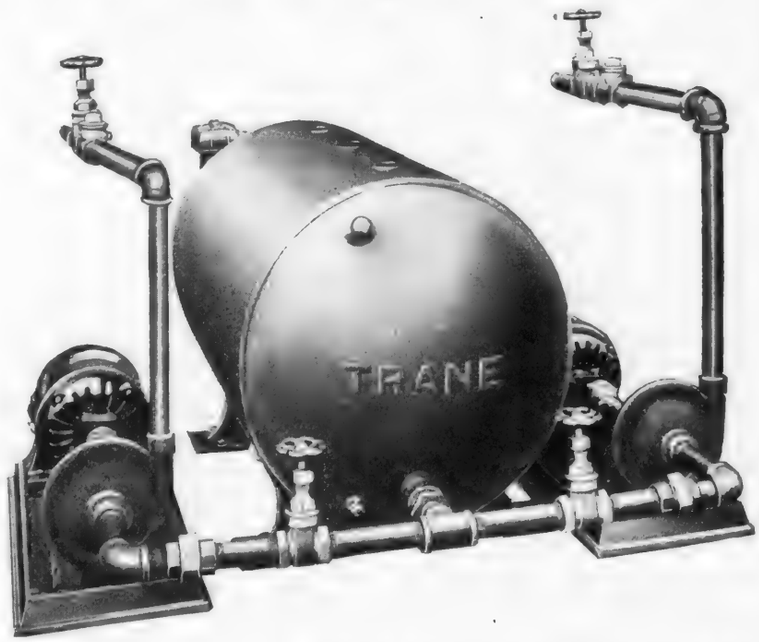
That's what they call the TRANE DIRECT RETURN TRAP—because that's what it really is. Trane Traps and broken boilers are never found on the same job.

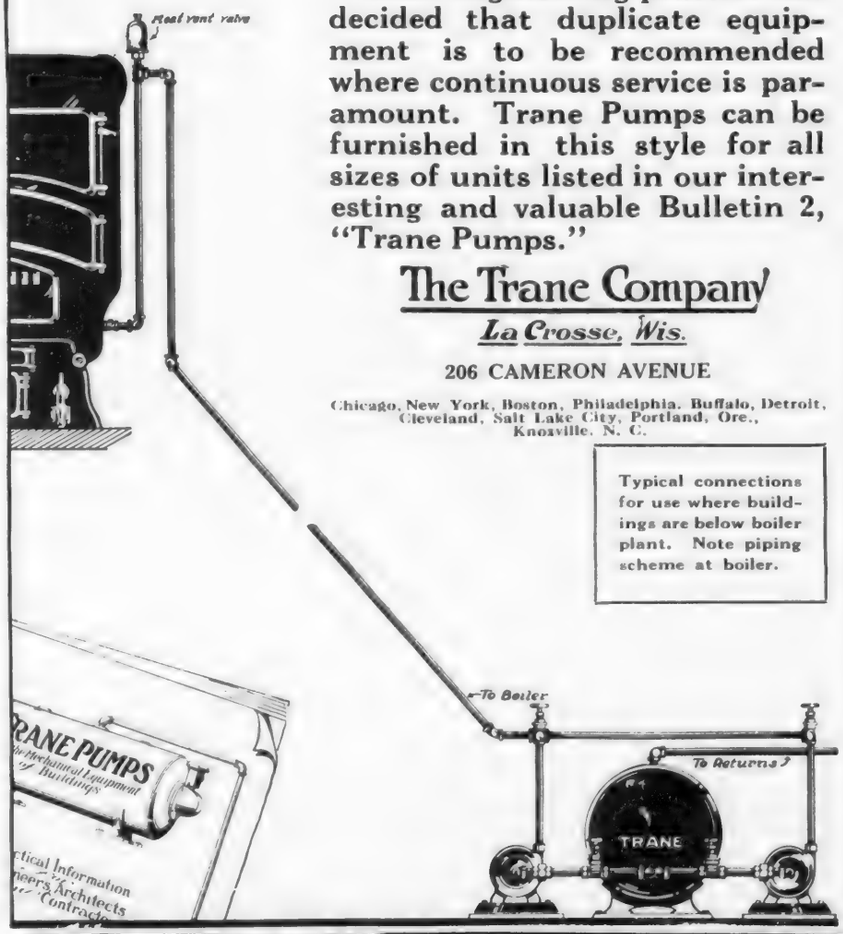
Bulletin 7 tells why.



TYPICAL BOILER CONNECTIONS for TRANE RADIATOR TRAP System of Vapor Heating, showing Direct Return Trap in position.

TRANE SYSTEM VAPOR HEATING
"Heat at the turn of a valve"





Good engineering practice has decided that duplicate equipment is to be recommended where continuous service is paramount. Trane Pumps can be furnished in this style for all sizes of units listed in our interesting and valuable Bulletin 2, "Trane Pumps."

The Trane Company

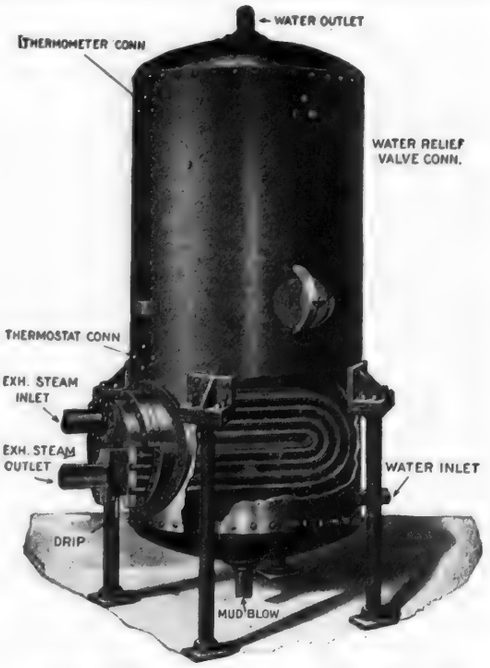
La Crosse, Wis.

206 CAMERON AVENUE

Chicago, New York, Boston, Philadelphia, Buffalo, Detroit, Cleveland, Salt Lake City, Portland, Ore., Knoxville, N. C.

Typical connections for use where buildings are below boiler plant. Note piping scheme at boiler.

TRANE PUMPS



WHITLOCK TYPE K VERTICAL HEATER

Why You Should Specify WHITLOCK WATER HEATERS

Measured by their performance, durability and efficiency, WHITLOCK Heaters are the most economical you can use.

They are built by an organization which for more than 30 years has labored to produce the best heating units possible, both from the standpoint of design and construction.

Practically every improvement in this type of equipment has been originated by WHITLOCK Engineers and developed in a plant devoted exclusively to the manufacture of heating apparatus.

The vertical type K heater, illustrated, is one of many examples of the superiority of WHITLOCK engineering. It saves floor space and operates on exhaust or live steam at a great saving over other methods of heating water.

We invite you to consult our engineering department about your requirements.

THE WHITLOCK COIL PIPE CO.

World's Largest Manufacturers of Service Water Heaters

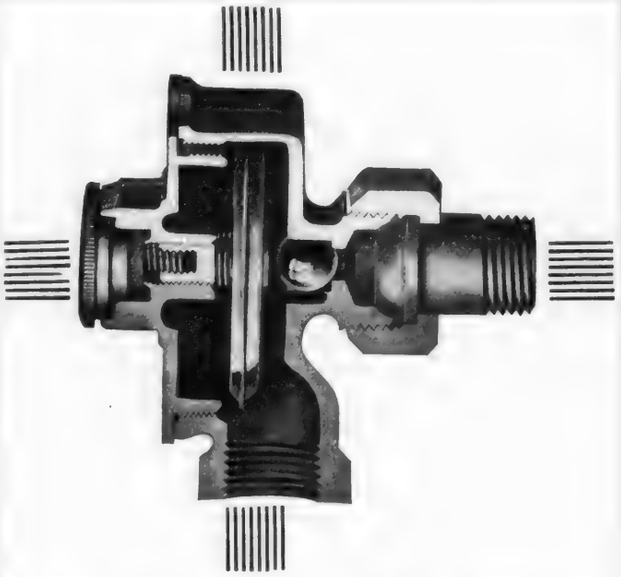
40 SOUTH ST. HARTFORD, CONN.

New York Chicago Boston Buffalo Philadelphia

WHITLOCK Heaters are manufactured in Canada by Darling Bros., Ltd., Montreal

WHITLOCK HEATERS

"Have Everlasting Copper Tubes"



A high grade thermostatic return trap

with the non-corrosive ball check feature

How it operates:

The non-corrosive ball-check operates on a smooth guide or track, and is rolled to its seat against vapor or steam by the expansion of gas in the thermal member. When the radiator supply valves are closed, condensation of the steam forms a vacuum in the radiators which holds the balls to their seats, permitting all water in the return lines to flow freely back to the boiler, thereby eliminating the danger of broken boiler sections and preventing steam or vapor short-circuiting into radiators through return risers.

Boiler Insurance

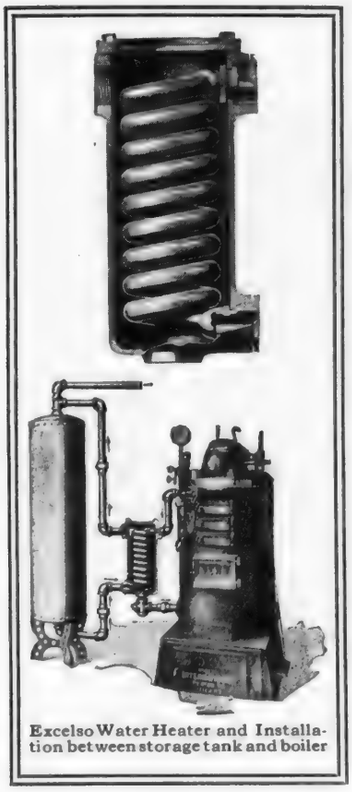
The O-E Combination Ball-Check Trap is the only trap made with the check feature, and it costs no more than an ordinary return trap. Engineers and Architects will specify "O-E" No. 2 as insurance against boiler damage, this insurance alone being worth more than the reasonable price asked.

O-E Specialty Manufacturing Co.

Manufacturers of the

Celebrated "O-E 3-in-1" Heating Specialties

MILWAUKEE, WISCONSIN



Excelso Water Heater and Installation between storage tank and boiler

Do Your Specifications Call For EXCELSO WATER HEATERS

The famous Excelso Water Heater connects on the outside of any steam or vapor heating boiler. Patented ground joints eliminate leaks. Sold and recommended by all the leadin boiler manufacturers. There can be no come-back when you recommend Excelsos—guaranteed or purchase price refunded. Thousands in use —a guarantee of their dependability and economy. The original indirect heater.

Sold and Recommended by Leading Boiler Manufacturers

American Radiator Co.
Richardson & Boynton Co.
Richmond Radiator Corp.
Standard Heater Co.
Utica Heater Co.
Burnham Boiler Corp.
Pierce, Butler & Pierce Mfg. Co.
United States Radiator Corp.
International Heater Co.
Boynton Furnace Co.
The Wm. H. Page Boiler Co.
Gurney Heater Mfg. Co.
Thatcher Furnace Co.
Abendroth Bros.
Monitor Bi-Loop Radiator Co.

Excelso Heaters are Nationally Advertised

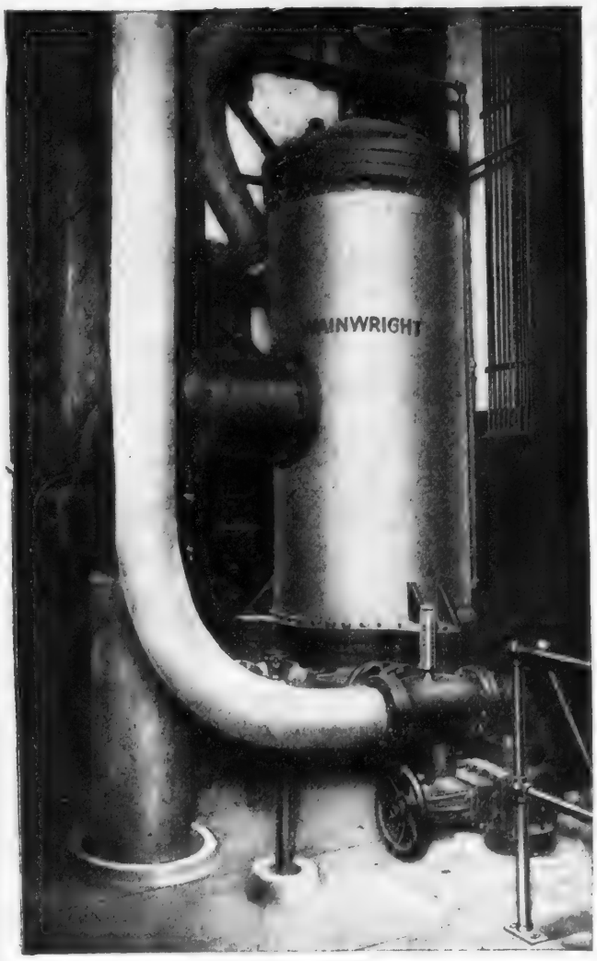
Excelso Advertising appearing every other week in *Saturday Evening Post,* and every month in *Good Housekeeping, American Magazine,* and other consumer publications helps Excelso distributors to build up a profitable business. Write today for full particulars, discounts, etc.

EXCELSO SPECIALTY WORKS, 117 CLINTON ST., BUFFALO, N. Y.

JOHN G. KELLY	DANIEL L. HANSON	GEO. E. KITSON CO.	D. N. STEDMAN	J. H. DALY
137 East 43rd St.	46 Cornhill	5029 Chester Ave.	Wrigley Bldg.	230 15th St.
New York, N. Y.	Boston, Mass.	Philadelphia, Pa.	Chicago, Ill.	Denver, Colo.

EXCELSO WATER HEATERS
Sold by All Plumbers and Steamfitters

"Wainwright" Hot Water Service Heaters



The essential features of these heaters are detailed in Bulletin which will be sent on request.

Straight tubes, separate water channels, tube heads and covers make cleaning easy. Dependable temperature control is furnished with heater, if desired, recommending these equipments for the most severe service conditions.

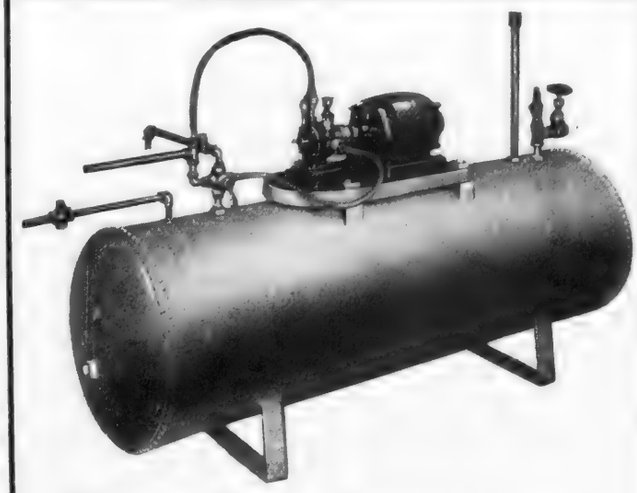
We also manufacture Centrifugal Pumps either motor or steam turbine driven, adaptable for circulating of pressure service on either hot or cold water systems.

Bulletin on Request

ALBERGER PUMP & CONDENSER CO.

140 Cedar Street, New York

Boston Chicago St. Louis Philadelphia



The Combustion Fuel Oil Burner

As safe and simple as your electric lights

MR. HEATING CONTRACTOR

The Combustion Fuel Oil Burner, which has been sold exclusively through the distributor, will now be sold directly through the heating contractor.

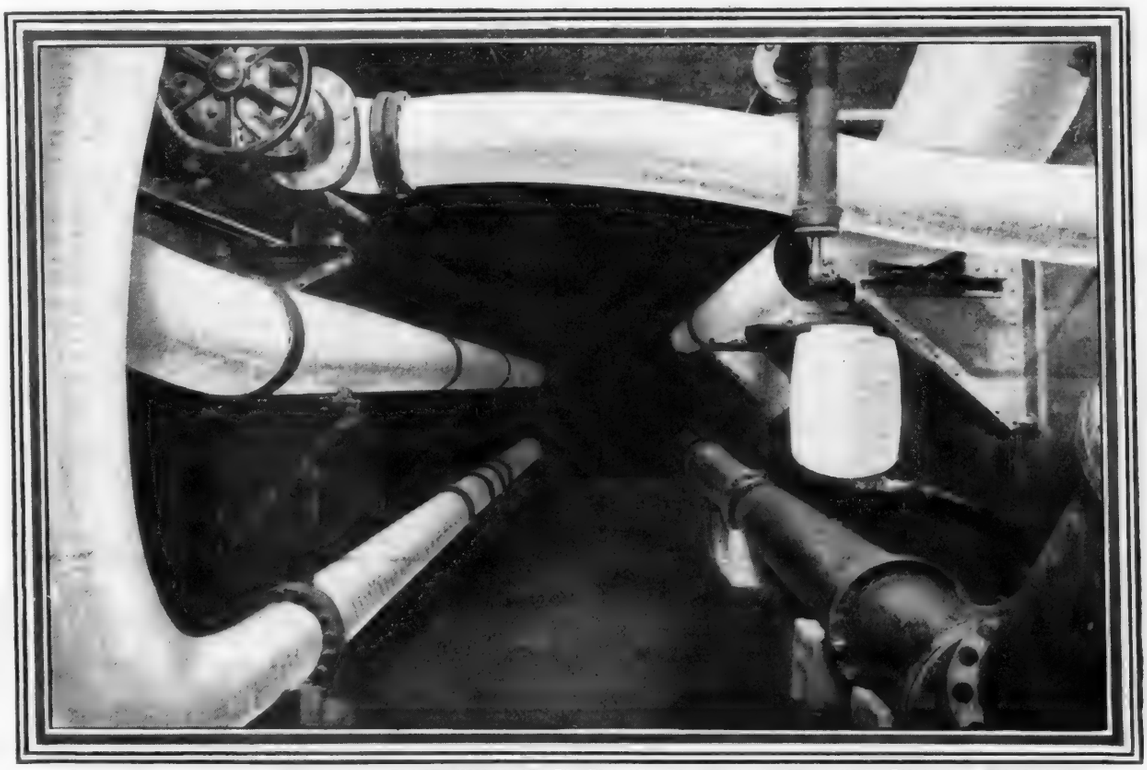
The Combustion Fuel Oil Burner can be installed in any kind or make of heater. The system consists of 5 simple elements —air jet nozzle, pilot light, motor-driven air pump, automatic thermostatic control and fuel tanks. The air jet nozzle is the burner and fires directly into the fire pot by spraying the oil into the flame of the pilot light. The pilot light is a gas flame that ignites the sprayed fuel oil. The pump furnishes a uniform supply of air and oil and the electric power required to run the motor is very slight.

Let us have your inquiry and get in on a tide of new business. Excellent proposition to dealers.

The Combustion Company

General Sales Office: 728 South Michigan Avenue
General Office and Factory: 4256 North Western Avenue
CHICAGO, ILLINOIS

Canadian Business
International Combustion Co. Ltd.
234 Beaver St. Montreal, Canada



CRANE PIPING IN THE TRUMBULL CLIFFS FURNACE CO. PLANT. FREYN AND BRASSERT CHICAGO, ENGINEERS

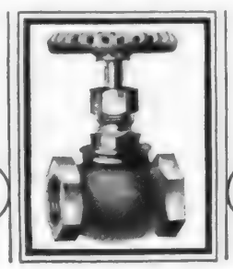
WHEN DEPENDABLE STEAM PIPING COUNTS

Steam pipe-lines located in tunnels or basements or buried in the ground must give dependable service at all times. Crane valves, fittings and pipe bends for such installations are designed and produced to stand up under the most extreme conditions. Only selected materials are used in the manufacture of Crane equipment. Production operations are checked by rigid inspections, and searching factory tests guard uniform quality in the finished units. This careful factory practice gives exceptional endurance to Crane piping equipment.

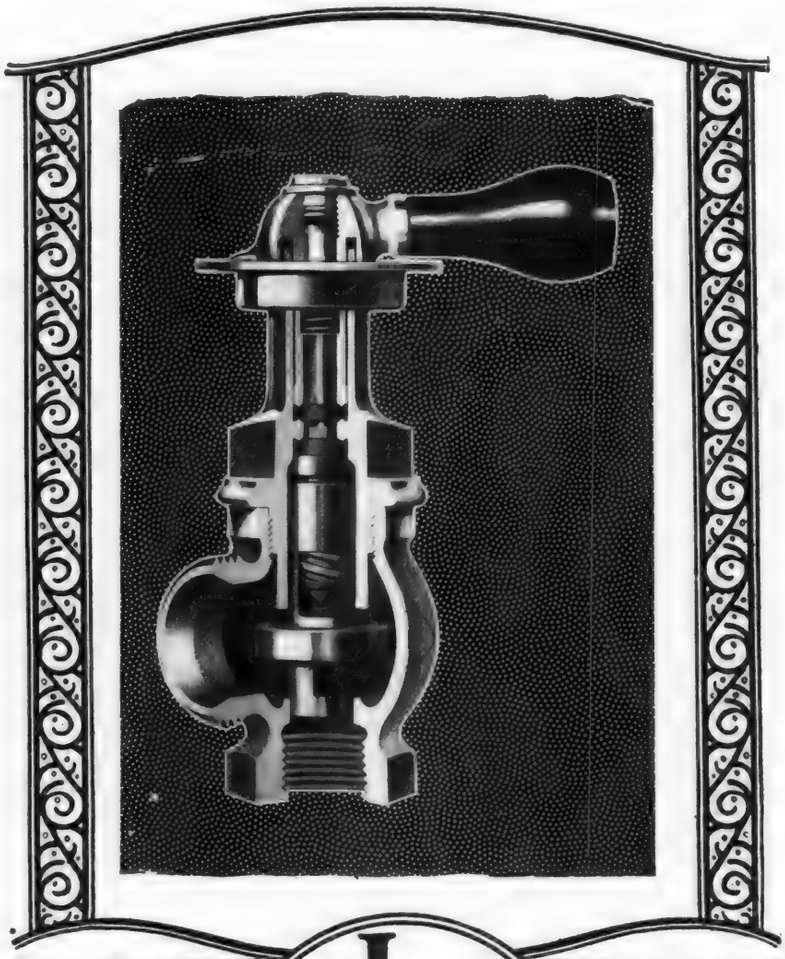
CRANE

GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVE., CHICAGO

Branches and Sales Offices in One Hundred and Thirty-five Cities
National Exhibit Rooms: Chicago, New York, Atlantic City
Works: Chicago and Bridgeport



Crane 75 Low Pressure Globe Valve



Lavigne Packless Valves

BUILT RIGHT **L** *TO STAY TIGHT*

When the steam-fitter installs a radiator valve, he introduces a fixture which is destined to occupy a very intimate place in that home for many years. The valve is a stranger to the house owner, whose good behavior the steam fitter vouches for. Can you afford to take chances?

Lavigne Packless Quick Opening Steam Radiator Valves are worthy of your confidence; their performance is a constant credit to the steam fitter who installs them. Beautiful in appearance and correct in design, they are the result of more than fifteen years' experience in the manufacture of high grade radiator valves. The complete range of styles and sizes satisfies every requirement for Vapor, Vacuum, Central Station or Low Pressure steam heating systems.

We also manufacture a complete line of high grade Steam and Hot Water Radiator Valves in all standard sizes and patterns.

Your jobber can supply you.

The COMMONWEALTH BRASS CORPORATION, Detroit

Branch Offices: New York Chicago San Francisco

LAVIGNE

PACKLESS STEAM RADIATOR VALVES

They blame you— when a valve leaks

WHEN a radiator valve leaks, nine out of ten of your customers won't blame the valve, they will blame *you*. And the chances are you won't even know why they forget to mention you when their friends become prospects for work.

Yet vouknow that when the stuffing box leaks you are *not* to blame. For if you pack the stuffing box too tightly, it is hard to turn, and if you pack it loosely, it leaks.

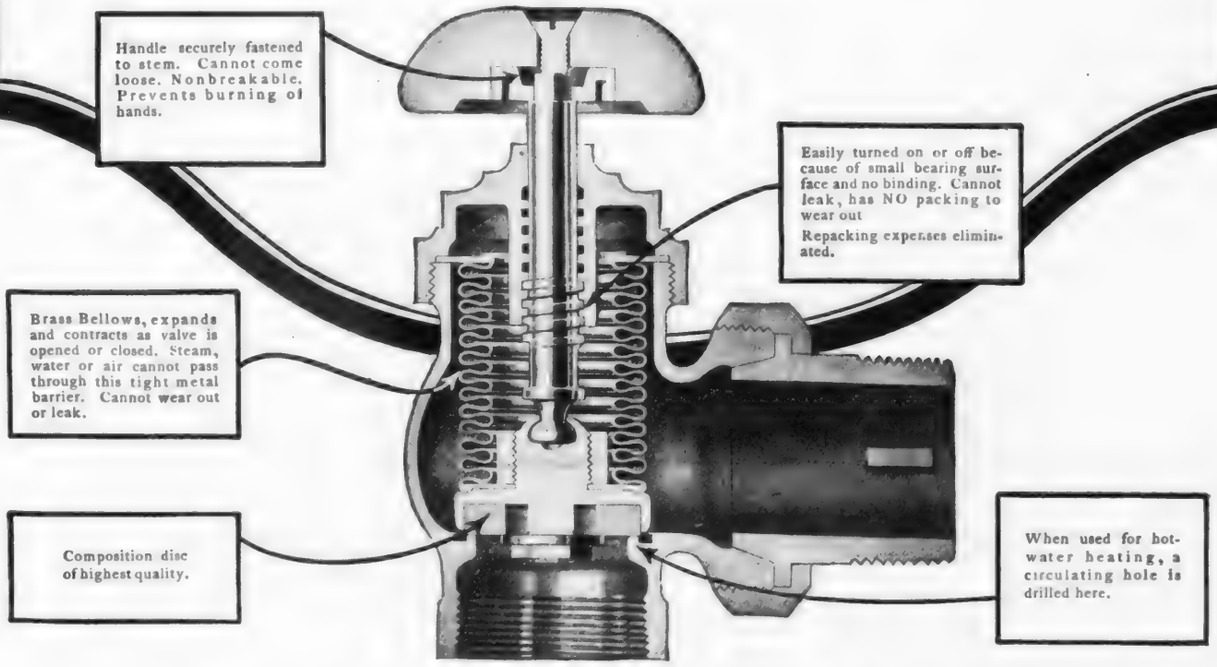
IDEAL PACKLESS VALVES will help you get away from this trouble. The metal bellows is so tight that no water, steam, or air, can possibly get through. And yet because of its small bearing surface and no binding, the valve will always turn easily.

To you, the IDEAL PACKLESS VALVE means not only satisfied customers, but more profit on repairs or new jobs.

We want you to prove this for yourself—so we are glad to let you have just one IDEAL PACKLESS at a very reduced rate.

This sample valve will prove to you that it will increase your profits. It will pay for itself several times over on the first job you change, and it will continue to pay dividends for years.

You can get your sample valve from our nearest Branch.


Handle securely fastened to stem. Cannot come loose. Nonbreakable. Prevents burning of hands.
Easily turned on or off because of small bearing surface and no binding. Cannot leak, has NO packing to wear out
Repacking expenses eliminated.
Brass Bellows, expands and contracts as valve is opened or closed. Steam, water or air cannot pass through this tight metal barrier. Cannot wear out or leak.
Composition disc of highest quality.
When used for hot-water heating, a circulating hole is drilled here.

IDEAL PACKLESS VALVE

AMERICAN RADIATOR COMPANY

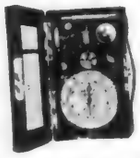
IDEAL Boilers and AMERICAN Radiators for every heating need

1807 Elmwood Avenue Dept. P-106 Buffalo, N.Y.

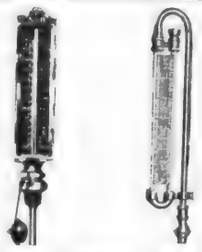
Columbia Recording Gauge

"Reform" Dial Thermometer

S & B American Gauge

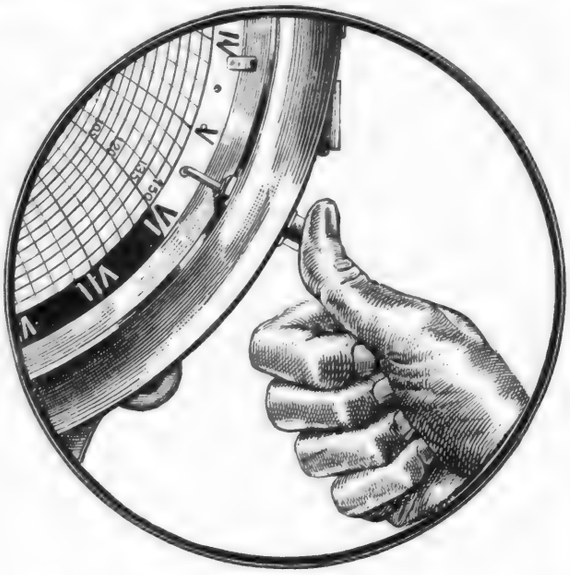


Columbia Hand Tachometer



& B "Crescent" S & B Thermometer U Gauge

"Redline" Differential Draft Gauge



This Time Punch Insures Manufacturers Against Waste, Workmen Against Injustice

The operator simply pushes the button when making each inspection of the temperature indicated by red line on the day-and-night chart and the exact time of inspection is recorded opposite temperature by small hole punched in the time border of the chart.

Thus the manufacturer is assured of the maintenance of the exact temperature required to turn out products of the highest quality at the lowest cost, without spoilage. For the operator knows that if he neglects to make regular inspections the dial will show his delinquency.

Columbia

Recording Thermometers

are also a protection for the employee, because they enable him to prove that he performed his duties, even if things go wrong In this way the blame cannot be put on the wrong man.

Any temperature up to 1000° can be accurately recorded.

Columbia Recorders with the new Time Punch cost no more than other recording thermometers without this valuable feature.

The Time Punch is also furnished on Columbia Recording Gauges and Tachometers.

Catalog N-14 sent on request. Write for it today.

Schaeffer & Budenberg Mfg. Co.
AND
American Steam Gauge & Valve
MFG. CO. DIVISION

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Buffalo *Los Angeles
*Chicago New Orleans
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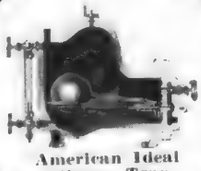
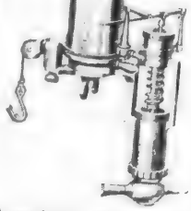
*Stock carried at these branches.

S & B Gauge Tester

S & B Engine Register

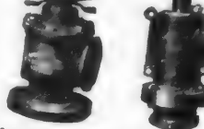


American Ideal Steam Trap

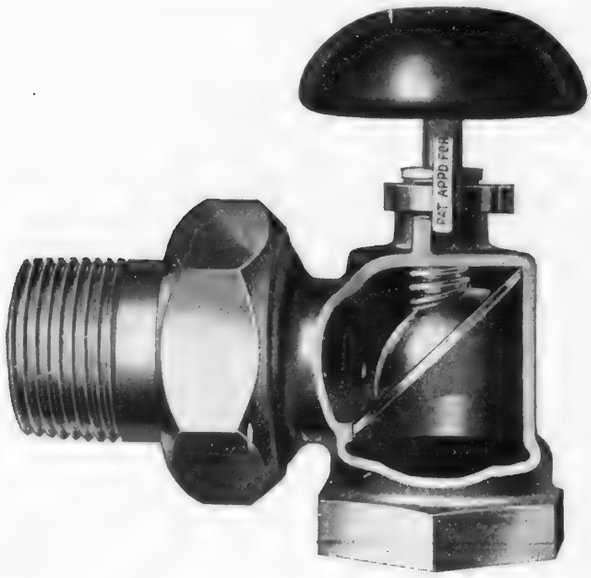


American Thompson Improved Indicator

American H_2O Grease Extracting Feed Water Filter



American Water-Relief and Pop-Safety Valves



"How do you balance a hot water job ?"

NO longer is it necessary to use expensive makeshift methods to secure a uniform flow of hot water through every radiator.

With the new "Genuine Detroit" Equalizing Hot-Water Valve, a simple adjustment can be made *after the system is in operation*. And the system may be easily and perfectly balanced.

The cut above shows how simple it is to make this adjustment. A pointer attached to the handle, stops when it reaches the "off" position. A movable stop collar makes it possible to regulate the size of the opening when the valve is turned on.

In this way you can decrease the flow through any valve and equalize the circulation throughout the entire system.

"Genuine Detroit" Equalizing Hot-Water Valves have these other exclusive advantages, too:

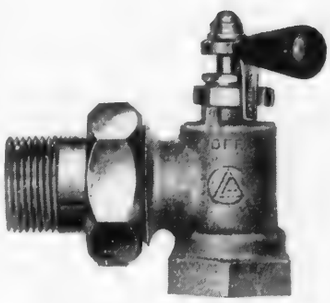
1 The curved inlet plate has less than one-tenth the contact surface of the old type valve. And the scraping edge keeps the contact surface clean so corrosion can't stick the valve.

2 The curved inlet plate makes the water *curve* into the radiator, instead of bumping into the old square cornered turn.

3 The handle is of a new design — non-breakable and non-heat-conducting. It is handsome in appearance with a permanent, black, hard-rubber finish.

Large stock of "Genuine Detroit" Equalizing Hot-Water Valves are maintained at the factory so that you can get immediate delivery.

Your jobber can supply you with these valves and we will be glad to send you a leaflet describing this new invention more fully.



These valves are made in both round handle (No. 104) and lever handle (No. 105) types.

"GENUINE DETROIT"
Hot Water Radiator Valves

DETROIT LUBRICATOR COMPANY

DETROIT, U. S. A.

2709 Grand Central Terminal
New York City

1328 Tribune Bldg.
Chicago

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San Francisco

"GENUINE DETROIT"

What You Want!

A SINGLE PIPE VAPOR SYSTEM

Simple to Install

—Any steam fitter can put in this System

LOW IN COST

Does the Work

—We have the successful installations to prove it

Descriptive matter sent on request

GORTON & LIDGERWOOD CO.

96 Liberty Street

NEW YORK

FISHER BUILDING, CHICAGO, ILL.

SARCO

Products that Increase Efficiency and Cut Costs

STEAM TRAP SARCO. Costing only one-third as much as "float" traps, the Sarco enables you to trap every point where condensation forms, thereby saving steam and fuel. No installation expense—fits into the line like an elbow. Has only one moving part—nothing to get out of order or require adjustment. Will not air bind. Booklet P-35 on request.

RADIATOR TRAP SARCO. A highly sensitive, factory-adjusted trap that keeps steam lines free from condensation. No water hammer or air binding. Maximum closing pressure—will not leak. Line contact between the cone and seat prevents scale deposit. Easy to clean. Exceptionally heavy construction. For vacuum, vapor and low-pressure steam heating systems. Write for Booklet P-109.

SARCO TEMPERATURE REGULATOR. Self-contained and automatic. Does not require electricity, compressed air or water. No rubber or leather diaphragms to give trouble. Factory-calibrated for desired range. Operates on steam, water and gas valves. Positive in action. Send for Booklet P-74.

SARCO INDICATING THERMOMETER. Manufactured under the famous Fournier patents, by expert thermometer makers in our own laboratories. Dial may be placed any distance from the sensitive bulb up to 500 feet or more. Indicates temperature of bulb only. For any desired range from minus 90° F. to plus 1300° F. Booklet P-153 on request.

SARCO STRAINER. For use in any installation where it is necessary to protect valves or other parts against the action of scale, sediment, etc. The large sieve area insures thorough straining without interruption of flow. Can be placed in horizontal or vertical lines, or at any angle. Blowoff connection permits cleaning strainer by simply opening valve. Quickly taken apart and reassembled. Ask for Booklet P-201.

Any Sarco Instrument sent on trial for thirty days

SARCO CO., Inc.

231 Broadway, New York City

Buffalo Chicago Cleveland Detroit Philadelphia

The B&B Line—World's Most Complete Line of Heating Specialties

VACU-TRAPS · MULTIFLEX TRAPS · MULTIFLEX VALVES · DAMPER REGULATORS · VENT VALVES · BLAST TRAPS · VACU-STATS · REDUCING VALVES · THERMOSTATS · PNEUMATIC VALVES

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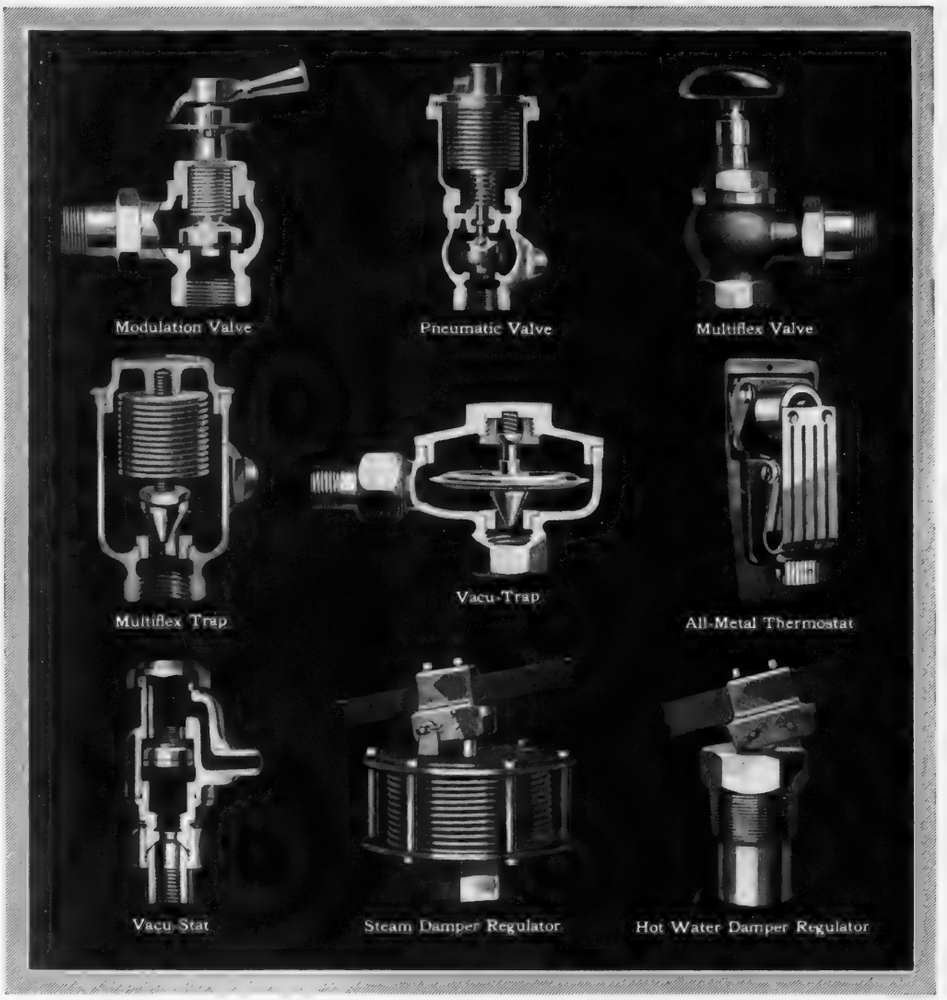


Here are the B. & B. appliances for heating and temperature control

FOR every heating or temperature control system which you are called upon to furnish, consider first the B. & B. Line.

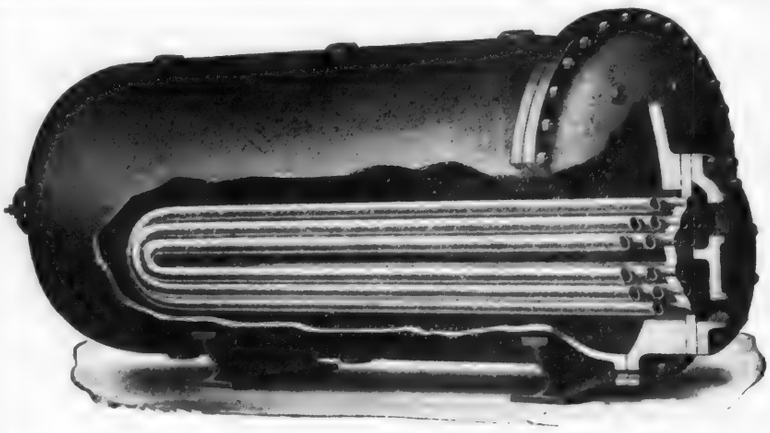
The appliances illustrated above represent but part of the B. & B. Line—a major part, perhaps, considering the thousands which are in use in buildings ranging from bungalow to skyscraper.

Any item of B. & B. Line is available for immediate shipment through the 23 Service and Sales Offices listed in the left hand column.

Get in touch with any one of them—or write us direct. Our representative will be glad to explain the new B. & B. Service-Plan of personal co-operation.

THE BISHOP & BABCOCK CO.

GENERAL OFFICES AND FACTORIES: CLEVELAND, OHIO



NATIONAL
U BEND TYPE

STORAGE HEATERS

YEARS of Experience in the Design and Construction of Feed Water and Storage Heaters explains in part the preference so many engineers show for heaters that bear our name. As evidence of their popularity, here are some installations of our "U" Bend Type of Storage Heater in a limited section of New England.

CAST-IRON or steel shells; seamless drawn copper tubes. "Out of Service" periods are few and far between where National "U" Bend Heaters are installed. The ease with which the heating element may be removed, for cleaning or repair, is appreciated by owner and engineer alike. National "U" Bend Storage Heaters assure a hot water supply whenever you want it. They use live or exhaust steam and heat either continuously or intermittently.

Harvard College	27	Heaters
Yale University	4	"
N. E. Y. M. C. A. Bldg.	8	"
Mass. State Armories	7	"
N. E. Tel. & Tel. Co.	7	"
Mass. Genl. Hospital, Boston	3	"
Psychopathic Hospital	4	"
63 Hospitals & State Inst.	92	"
106 Mfg. Plants & Text. Mills	129	"
49 Schools, Colleges & Pub. Bldgs.	87	"

SEND FOR BULLETIN No. 54

The National Pipe Bending Company

120 RIVER STREET **Established 1883** **NEW HAVEN, CONN** 4711

In Public Buildings—

Baltimore
Recreation Pier
Webster Equipped

as in every other type of building, Webster Systems of Steam Heating are preeminent.

In selecting heating equipment for public buildings, Webster Heating System Engineering Service is particularly helpful to bidders and consultants in placing at their disposal a 33-year experience in desigring steam heating systems, a vast amount of authoritative data based on 17,000 installations in every size and type of building, and apparatus of unquestioned mechanical excellence and fully demonstrated effectiveness and economy.

May we explain in full the details of Webster Equipment and Webster Service?

Write for Bulletins

WARREN WEBSTER & COMPANY

Main Office and Works: Camden, New Jersey

Branch Offices in All Principal Cities

Webster

MODULATION SYSTEMS OF STEAM HEATING
VACUUM SYSTEM OF STEAM HEATING
STEAM AND OIL SEPARATORS
FEED WATER HEATERS
STEAM SPECIALTIES

160

BARNES & JONES

System of Heating

Installed Throughout

The COMMERCE BUILDING
BOSTON, MASS.

Built to be one of the Highest Quality Office Buildings in Boston

Coolidge & Shattuck, Architects
Buerkel & Co., Engineers

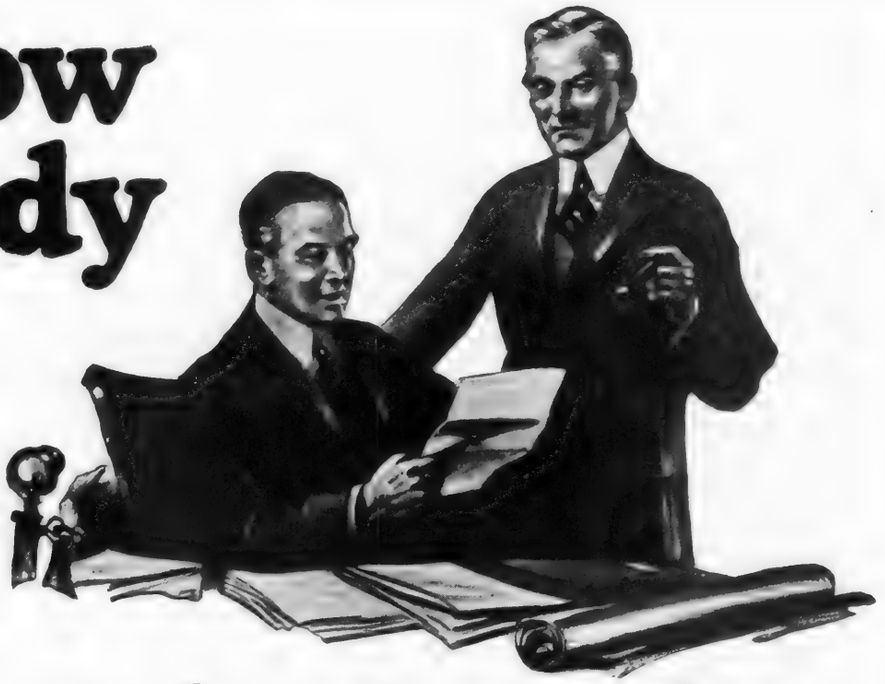
Geo. A. Fuller Co., General Contractors
Cleghorn Co., Heating Contractors

BARNES & JONES
5 Melrose St., Boston (11), Mass.

New York Office
Grand Central Terminal

REPRESENTATIVES
PRINCIPAL CITIES

"Now Andy



We're going to make real money on this job"

"In submitting this proposal, I specified Moline Heat, and now that we've landed the job, we know exactly what we're going to make. You know as well as I do Andy, that we made practically nothing when we used to bid on a strictly competitive basis on old style heating systems. Some trouble came up which cut out most of our profit, nearly every time. Am I right?"

"You've hit the nail on the head Bill. From now on, we are going to give something better and we'll be out of the 'cut price bidding game'. There's nothing in it for us—or for our customers.

"Now with the Moline Heat proposition we can go before any building committee with the feeling that we are selling more than mere equipment—we're selling results. That's what the owner is interested in. We're selling a system that insures satisfactory heat under all conditions—a heating service that means lower operating cost. We can prove that in most cases complicated 'cure all' devices are a confession of poor engineering and faulty installation.

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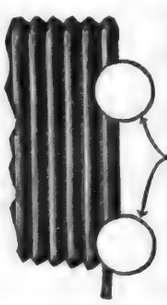

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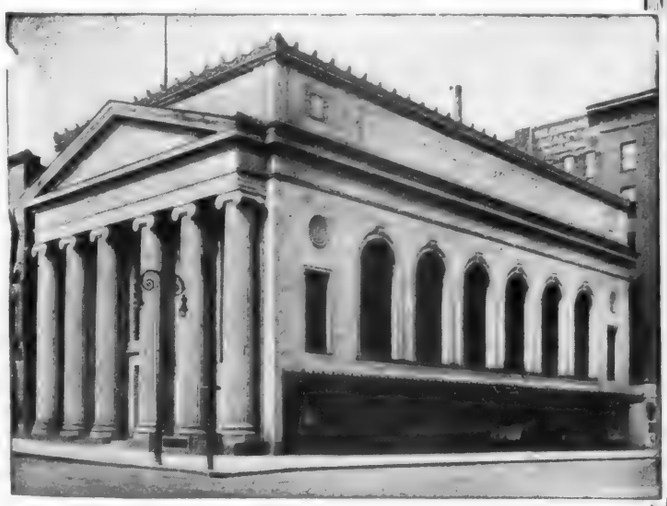

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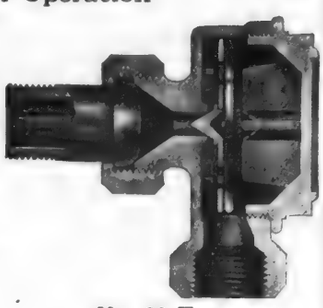

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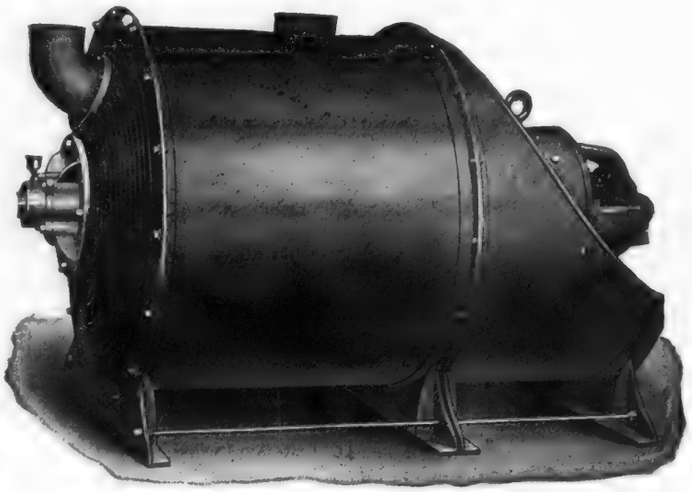

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A MONTHLY JOURNAL OF ENGINEERING PROGRESS

DECEMBER, 1922

Space Requirements for Mechanical Equipment

The Amount and Location of Quarters Usually Available for the Various Utilities and the Form of Building Construction that Will Facilitate Their Installation

By H. L. CLUTE.

(From an address before the Western Society of Engineers, May 10, 1922, and here first published).

BUILDINGS may be divided into two general classes, those which are intended to house mechanical equipment and those to which a certain amount of equipment must be fitted. The former class includes all factories and power plants. The second class includes hotels, apartments, theatres, office buildings, hospitals, in fact, all kinds of buildings except factories and power plants.

The mechanical equipment of a building may be described as that part which furnishes the utilities, such as water, gas, refrigeration, electricity, conveyance, etc. it is the dynamic, as opposed to the static, structure. It might at first glance be compared to the organs of the human body in their relation to the structure of the body. Yet this is not true. Buildings existed and served useful purposes long before the first item of mechanical equipment was known. They could still exist and serve the purpose for which they were intended. As an investment, however, a building without a certain amount of mechanical equipment would be an absolute failure.

In discussing the structural provisions of a building, by which is meant the amount and location of space, the important point to consider is the form of construction best adapted, or perhaps I should say advantageous, for the mechanical and electrical equipment. If I should say best adapted, I might imply that I thought the building should be arranged particularly to suit the equipment which, of course, is not the thought I have in mind.

THE MECHANICAL EQUIPMENT.

Mechanical equipment is usually divided into installations corresponding more or less closely to the functions performed.

There are three groups that are common, I say common because each one of these groups is represented in practically every building. They are plumbing, electric wiring and steam fitting. The plumbing, of course, includes drainage, water supply, plumbing fixtures, gas fitting and usually vacuum cleaning, when its installation is included with the plumbing. Wiring includes distribution for electric light and power, signal systems, telephone systems, teleautograph, clock system, etc. Steam fitting includes the boiler plant, steam distribution and utilizing apparatus, such as for heating and other purposes.

There are six kinds of installations that may be called semi-common, because they occur only in two or three of the different kinds of buildings and are not represented usually in every building. These are ventilating, electric generating refrigerating, elevators, pneumatic tubes and sprinkler systems.

There are a number of special installations, each intended for a particular type of building. Examples of these are equipments for kitchens in hotels, laundries, theatre stages, manual training, garbage disposal, etc. In fact, these merge into equipments used for manufacturing purposes which are infinite in number.

ANALYSIS OF TYPICAL INSTALLATIONS.

Each of these installations may be considered as made up of three items: apparatus, conductors and accessories. The apparatus consists of such items as occupy a certain floor space designed and made up complete in factories and installed. Examples would be boilers, pumps, tanks, fans, motors and such parts. Piping includes, for drainage, two systems of mains usually a high-level system and a low-level system: a subdrainage system, and separately as a rule, a storm water system. Steam fitting in a typical case would consist of three distribu-

tion systems, low-pressure, medium-pressure and high-pressure. Each of these requires a supply main, a return main and a drip main, except in the case of the high-pressure, where the exhaust would take the place of the return. Refrigeration includes brine supply lines and returns. Sometimes the distribution is by direct expansion in addition, which would require two more mains.

I should have mentioned in connection with plumbing that this installation includes, under water supply, two mains for cold water, one at city pressure and one at high pressure; for hot water, a supply and circulation and return main for each, city pressure and high pressure; it also includes mains for drinking water supply and drinking water return.

For the sprinkler system we have a supply main and a drainage main. For electric distribution there is a system of feeders going out from the central point to supply branch centers for final distribution.

Ventilating systems may be resolved into three fundamental types: distributed supply, distributed exhaust and one-point supply and exhaust. Each of these three systems of operation may be comprised of horizontal distributing ducts or vertical distributing ducts with branches, the vertical ducts being supplied by horizontal trunks.

Since each of these installations may be divided into three parts, then we may say that the entire equipment as a whole is made up of those three items: apparatus, conductors and accessories. Under conductors we would include piping, wiring. pneumatic tubes and ventilating ducts.

Picture, then this system of piping: thirty systems of mains as a typical example, some of them extending entirely around the building in the form of loops, some of them as trunks with transverse sub-mains, some of them with several trunks and transverse mains; each of these mains with from five to 100 risers extending up through the building, each riser with anywhere from four to forty branches; with the mains, of course, located at different levels and the risers extending either up or down. Interspersed with this system will be anywhere from five to twenty duct lines, some of them short, others extensive, all with numerous branches; also the pneumatic tubes traveling from a central point to all parts of the building, perhaps, without any typical location.

Picture this piping with the major apparatus attached at various points, like fruit hanging from the branches of a tree. Picture it first in the ideal condition, with all of the mains traveling by the shortest distances from the producing apparatus to the utilizing apparatus in lines, of course, parellel to the major axes of the building. Then imagine it twisted and contorted as it necessarily must be to conceal it in the building construction if it is to be put out of the way and, to a considerable extent, out of sight. That sometimes is one of the main problems of the mechanical engineer.

STRUCTURAL PROVISIONS TO BE CONSIDERED.

The structural provisions may be generally stated as floor areas properly located and of proper size to accommodate the major apparatus, continuous horizontal spaces for the mains, continuous vertical spaces for the risers, more or less discontinuous spaces for offsets in risers and for branches, and facilities for operation and maintenance. It would, of course, be impossible, to try to cover in detail all of the provisions that are necessary. I wish rather to take up some of the features of the major apparatus, showing the considerations that must be taken into account, and also systems of piping, and what can be done in a general way to accommodate these. For this latter purpose it may be convenient to divide the subject of piping into mains, risers and branches.

SPACE REQUIREMENTS FOR ELEVATORS.

Taking first the question of elevators. Until the advent of the traction elevator the machines were located in the basement, usually at the side of the hatchway. But now the electric traction machine is always located over the hatchway, usually on I-beam supports, which are carried on the pent house walls and sometimes on special beams provided for the purpose, or perhaps on a concrete slab.

Originally elevator pits were perhaps 15 or 18 in. deep, simply deep enough to take the platform. Then came the spring buffers, with a pit 3 ft. 6 in. to 4 ft. deep. After that came the oil buffers with a pit 6 ft. to 8 ft. deep. Then came the compensating cables which required sheaves in the bottom of the shaft to carry cables attached to the bottom of the car, around the sheaves and up to the top of the car, to compensate for the varying load of the lifting cables as the car travels up and down. For this 9 ft. is about the least depth the pit can be made. Elevator manufacturers are always asking for more depth and we don't know where the limit will be. This pit involves considerable difficulty at certain times. It is usually below the lowest part of the rest of the drainage system and requires a special depth of ejector or perhaps a separate ejector.

HOUSE TANKS.

Another item of equipment is house tanks. Every building requires a house tank, large enough to supply the building for perhaps 20 or 30 minutes and some for an hour or so, in emergencies. Sometimes an attempt is made to furnish a house tank of sufficient capacity to supply the building for a considerable time. For example, the Morrison Hotel, in Chicago, has two tanks, each of 10,000 gal. capacity for domestic supply. Two tanks are better because it permits one of them to be cut out of service and cleaned, without shutting off the water. Provision must be made for supporting the tanks filled with water.

ANALYSIS OF VENTILATING EQUIPMENT.

For the ventilating equipment air conditioners are required, that is, for the supply system. The air conditioners include tempering heaters, blast heaters, air washer, reheaters and, of course, fans and motors. Sometimes these also include refrigerating coils for the supply of cooled air.

The ideal location for the air conditioners and fan units is as nearly as possible in the direct line of travel from the intake to the rooms to be ventilated. In case the room to be ventilated is above the ground floor an objection arises immediately. This would involve placing the air conditioner above the ground floor where the space is valuable and it would cut off a considerable

amount of window area which is also very important. The air conditioner, however, can be placed in an interior room without disadvantage and these interior rooms may be made available with an intake duct carried over the ceiling of some one of the rooms.

IDEAL LOCATION FOR AIR CONDITIONING APPARATUS.

A fine place for air conditioners in a large building, where a number of them is required, is back of the elevators. Banks of elevators are very often placed against the rear wall of a building and have window area. Window area is not necessary, as I understand it, in elevators. If, then, this wall should be extended back sufficiently to accommodate a tier of ventilating units back of the elevators they are in the finest kind of position. The air intake is directly to the units. The units will be centrally located so that distribution is made either way and they can be stacked up, one above the other, the full height of the building, if necessary. This, of course, saves the travel of the air from the intake down to fans located in the basement where they are more likely than not to be otherwise placed because of the more available space. It saves also the travel of the air back from the basement to the room to be ventilated, the extra cost of the duct work, the space required through each of the floors for the ducts and the extra cost of power for operation.

SHAPE OF SPACE FOR VENTILATING UNITS.

The shape of the space for ventilating units should be long and narrow so that the air may travel direct from the intake straight through all the parts of the air conditioners without changing direction. The length of the unit is practically constant, 26 ft., including the washer, fan and direct connected motor, regardless of the capacity, although of course it would vary a little with different sizes of fans. The width is variable. If you know the capacity of the unit, in cubic feet per minute divide by 400, which is an allowable speed for the air through the washer, and the result is the area in square feet. Dividing the square feet area of the washer by the available height of the room, gives the width. To this we must add at least 4 ft. for piping connections and passage way. Five feet is preferable, if it can be obtained.

The weights of these units are of importance in some cases where the fan is placed on top of a floor fill of considerable thickness, with the duct system in the floor fill and the air chamber or discharge from the fan carried under the fan unit itself. Sometimes it is a problem that must be worked out carefully, because the blast heaters are concentrated loads and the weight is considerable in large units.

Exhaust fans may seem to be of small importance as far as space requirements are concerned, yet a building handling 200,000 or 300,000 cu. ft. of air per minute must have exhaust fans which occupy no little space and they have to be provided for, more particularly in the provision of space rather than in structural strength in the building. As the exhaust is through the roof, the fans may be located in the pent house or at the bottom of the shafts in the basement. In most cases they are located at the tops of the shafts in added spaces in the pent house.

Construction of the ducts through the roof is a matter that deserves consideration to make the roof waterproof. I find the best way is to provide an opening through the roof, put a curb wall around the opening and carry the discharge duct through this opening with a hood above to protect the space within the curb wall from the weather.

SPACE ALLOWANCES FOR BOILERS.

An item which is never forgotten in a building, even in the preliminary stages, is the boiler. Everybody provides space for boilers, though very often it is entirely inadequate. It is an easy matter to approximate roughly the size of boilers required for a building. A typical ratio of cubic contents to square feet of steam radiation is 70. This is not an average. An average is of no use. A building that is exposed on all sides, with not too many re-entrant angles, will be heated by radiation in amount equal to the cubic contents divided by 70. That is close enough for determining the preliminary size of space required for boilers.

It is sometimes thought that the number of boilers is determined by using the least number of the largest size that will go into the building. This is, I believe, not the correct method. Two boilers are always better than one. During a great part of the heating season one boiler will carry the entire load and at a greater efficiency than a boiler of twice the size; this provides a reserve boiler during the greater part of the year in case of emergency breakdowns, and without any greater total boiler capacity.

Three boilers are better than two for plants of over 15,000 sq. ft. of radiation. With three boilers of a total capacity equal to the total load on the building, one of them may be shut down and the other two run 50% overload and they will carry the entire load of the building under maximum conditions.

CONDITIONS IN DETERMINING SIZE OF BOILERS.

In determining the size of the boilers there must be added for some classes of buildings a certain amount for operating kitchen equipment. A hotel is the maximum condition. Office buildings may run as low as 10% and of course this item is almost negligible in some buildings. Apartment buildings are classed with hotels or nearly so. In addition, if there is a generating plant, we must allow for that, using 75% of the steam used for generating as available for use at low pressure for heating.

HEIGHT OF BOILER ROOM CEILINGS.

The height of ceilings in boiler rooms is usually a matter of argument. Architects always want to cut down ceiling heights and to keep them low. Of course, there is a reason for this. They don't want the ceiling of the boiler room to extend up into the other parts of the building and they don't want to carry the excavations deeper than necessary. But there should be space above the boilers to allow for the maintenance of the accessories to the boiler, such as safety valves, main valves, particularly those on high-pressure boilers, and automatic stops and checks which must be tested and kept in order.

As far as height is concerned, we may class boilers into three divisions, (1) cast-iron, (2) firebox and return tubular, and (3) water-tube. For space considera-

tions we may say that the various makes of each type are roughly the same. The ceiling heights for these types of boilers may be taken as 9 ft. 15 ft. and 28 ft., respectively. Nine feet will accommodate a cast-iron boiler, 15 ft. will accommodate a return tubular boiler and any of the firebox boilers, while 28 ft. is the least that should be allowed for a water-tube boiler, although some are provided with horizontal tube baffling that can be placed so as to bring down the height to 20 ft.

Some boiler rooms have a height of 32 ft., as in the Morrison Hotel, where horizontal water-tube boilers of the Edgemore type are used.

PROTECTION OF FLOOR ABOVE BOILER ROOM

Protection of the floor above the boiler room sometimes gets us into trouble. Heat transmission from the boiler through to the floor above must be prevented. There are two ways that I know of for doing this. One is to insulate the ceiling. The other is to provide an air space for the circulation of air above the boilers. Either one of these ways will accomplish results. I prefer to insulate the ceiling because it not only prevents the transmission of heat, but also produces a condition whereby the amount of heat lost from the boiler is less. *

Separate and distinct from the height of the boiler-room ceiling is the height of the boiler room in respect to the ceiling. With low-pressure plants, if it is desired to return the condensation from the heating system by gravity, the water-line of the boiler must be 26 to 28 in. below the lowest space occupied by the steam in the system. In the down-feed system the bottom of the radiator is the lowest point. If it is an up-feed system, of course the lowest point in the mains is taken.

BOILER FOUNDATIONS.

Foundations for boilers are well provided by making them integral with the floor slab and reinforced, of course, thicker than the regular floor slab. A great many structural engineers build foundations that way. A possible objection to this method is that the heat from the boilers may cause the concrete to crack, but I have seen a great many installations made in the manner described without giving trouble.

In addition to the space required by the boilers themselves, there must be space for access on all sides and a firing space in front. The space in front for firing may vary from 5 ft. to 10 ft. Ten feet will accommodate any kind of stoker. Even a chain-grate stoker may be taken out in this space. A blow-off trench should always be provided at the back of the boilers, because blow-off pipes are at the floor and are likely to become stumbling blocks in the passageways unless they are in a trench.

THE PLACING OF SMOKE-STACKS.

A smoke-stack is another item that is never forgotten, but there is always a question as to just how much space to allow for it. Knowing the capacity of the boilers in square feet of radiation, the approximate size of the smoke-stack may be obtained by dividing the number of square feet of direct steam radiation by 2500. This is not a final figure but it will closely approximate it. To this, of course, must be added the thickness of the insulation, 3 in. on each side, and clearance between the stack and the building, 4 in. on each side. This is a quick method of roughly determining the size of the space for the stack.

The stack must be supported at one point, as it varies in length with the temperature. Sometimes it rests on a girder at any point in the height of the building, sometimes at the lowest floor on a foundation. The support is a matter which must require special attention on the part of the structural engineer. *

SPACE FOR ENGINES AND GENERATORS.

When engines and generators are installed, they must have a room of sufficient height. With an engine or a generator of from 200 to 400 kilowatts capacity, which is the range of the sizes usually included in these buildings, a ceiling height of 15 ft. is sufficient. This gives space for the considerable amount of piping which must be placed on the ceiling. Engine foundations must not connect with the column footings. It is a calamity to connect engine foundations integral or against footings as it will likely be a continual source of trouble. The vibration is transmitted readily through the building. The foundations may be placed separate and distinct where the soil is clay. The floors may be brought up to the foundations with a small joint between, filled with an elastic material so that the transmission of vibration from the engine foundations transmitted through the building is entirely eliminated.

It is always desirable in an engine room to have a trench or a tunnel for the exhaust pipes. The height of a tunnel should be at least 6 ft. so that there will be ample space, and at least 4 ft. 6 in. wide to accommodate the exhaust pipes, with side trenches leading out to the exhaust connections of the engines.

HANDLING OF COAL.

Coal is handled either by gravity direct to the stokers or by a low-level coal bunker. When it is handled directly to the boilers the main bunker is sufficiently high above the boiler-room floor to permit the coal to be fed directly to the stoker hopper. About the least height from the bottom of the bunker is 12 ft. Then, of course, the bottom of the bunker must slope up at an angle of 40°, so that to get a sufficient capacity for gravity feed to the stoker we must have a basement or sub-basement for the boiler around 30 ft. high. When this is not possible the main bunker may be on the boiler-room floor, with an auxiliary bunker placed sufficiently high to feed the stokers directly, with a conveyor handling the coal from the lower to the upper bunker, as required. In a great many cases coal is hand-shoveled to the stokers for which no special provisions are necessary.

REMOVAL OF ASHES.

Ashes are handled either by taking them directly from under the grates or through the pits underneath the firing space, that is, under the stokers. The ashes are

* In the ensuing discussion one of the questions asked was as to whether exhaust fans could not be used to advantage to ventilate the space above the boilers and at the same time supply the highly-heated air for feeding the fires down at the floor level. Mr. Clute considered this a good suggestion where forced draft were used. He added, however, that it is sometimes difficult to arrange and accommodate the equipment.

* The discussion brought out an argument for separate foundations for smoke-stacks on the ground that a high stack is apt to sway a little and should therefore be more firmly secured than it would be if placed on a girder.

often removed by conveyors, either manually or steam-operated.

When the ashes are handled by a conveyor it is always desirable to have a pit directly under the stoker, as the stoker will not feed directly to the conveyors continuously. The ashes must be allowed to accumulate in the pit and then raked into the conveyors. Sometimes a tunnel extends underneath the stokers and the ashes are fed continuously into cars, on industrial tracks. This, however, is very uncommon in the class of buildings under discussion.

FINDING PLACES FOR RADIATORS.

Radiators may seem of small importance and not necessary to be considered, yet they sometimes become a problem. Sometimes there is no available space for installing the direct radiators in the rooms. This is more apt to be so when the windows extend down to the floor and occupy the full width of the bays. Often radiators are recessed under the windows, in which case the recess of proper depth and height must be provided. The height must be more than the actual height of the radiator; in fact, it should be the height of the radiator plus the thickness to allow passage for the air that travels through the radiator. It is usually well to provide special space for radiators in certain portions of the building, such as stairways, corridors, main vestibules, etc.

LOCATIONS FOR STEAM AND OTHER MAINS.

There are about fourteen locations for steam and other mains. These may be divided into three groups: at the bottom of the building, intermediate and at the top. The easiest way of disposing of the mains is to bury them in the ground. This is done with at least one sewer system, but usually nothing else, as it is not advisable to place any kind of pipe except cast-iron or tile in the ground.

Underground conduits is a form of construction that is often used for a number of kinds of mains. Very often the returns from heating systems are so placed. The conduits, usually of vitrified tile, may be solid or split. In the case of solid tile the pipes are laid at the time the tile is laid, covered, and the tile put in place. The objection to this is the fact that the pipes are not so accessible if trouble occurs. It is first difficult to locate the trouble and next it involves tearing up a considerable amount of floor to make repairs.

To overcome this objection of inaccessibility, mains are often placed in trenches flush with the bottom floor. These trenches are made of conduit tile, pipes of various kinds are placed in them and a cover is formed of concrete slabs or, in the case of wood floor construction, sections of the wood flooring are made up and put over them. In this way the pipes are rendered accessible.

There is, however, a serious objection to any form of trench. The joint between the cover and the floor is always a dirt catcher. The covers are never quite flush with the floor and altogether they are unsightly and a nuisance.

TUNNELS VERSUS TRENCHES.

Next to trenches we have tunnels to consider. Tunnels must be or should be at least 6 ft. high and 4 ft. wide. These are not used in buildings except for trunk lines distributing from a central point considerable distances to sub-centers for final distribution. When the boiler-room floor is considerably below the balance of the floor of the basement, it is very convenient to dispose of certain trunk pipes in this manner, as it keeps the regular basement floor clear.*

REQUIREMENTS OF HOTEL KITCHENS.

Hotel kitchens require a greater number of utilities than any other part of the building. In fact, practically every one of the utilities required in the kitchen and ordinarily the mess of piping on the kitchen ceiling is very objectionable. It detracts from the general appearance of the room when it is desired to make it look as wholesome as possible.

When a hotel has a kitchen at about grade level, with no regular basement underneath, the most satisfactory method of disposing of the pipes is to place them in a sub-space 3 to 4 ft. high under the kitchen. Every pipe may be carried in this sub-space except, perhaps, the vent pipes from the fixtures which must not be run down to this space, but they are small and can be disposed of within the partitions, or otherwise concealed. This makes the finest construction I know of for this purpose.

* In the discussion the practice of using pipe tunnels in the basement was questioned, largely on account of the possibility of steam leaks. Mr. Clute expressed his preference for the tunnel construction, stating that there should be means of egress at both ends.

(*Continued on page 40*)

Sampling Delivered Coal

In sampling delivered coal the Bureau of Mines follows a definite procedure. A sample weighing not less than 1,000 lbs. is systematically collected by taking equal increments at regular intervals throughout the delivery, while coal is being loaded or unloaded, and crushing and reducing this sample by successive stages to laboratory size. In using analyses of samples of delivered coal, the reader must recognize that the coal is not always of uniform size, and that the impurities are not uniformly distributed throughout the mass. Some variation in the results obtained are consequently to be expected; if the same mass of coal were sampled a number of times the analyses would not agree absolutely except by chance. It is only when a considerable number of such analyses are available representing a considerable tonnage mined over a period of time that the average value and range of variation of a particular coal become known with assurance. With reasonable tolerances, however, for these variations, delivered coal can be sampled accurately enough for all practical purposes. Deliveries from any one mine may vary in quality from time to time because of changes in mining or preparing the coal, and an analysis of deliveries for any one date should not be considered as establishing a permanent standard, for the output may be greatly improved by new methods of mining and preparation, or it may deteriorate through the carelessness of the miner and the operator.

Improving Air Conditions in a Chicago Bank Building

How Tests Disclosed the Faults in the Ventilating System and Suggested the Remedy

BY E. VERNON HILL.

II

IN last month's issue of THE HEATING AND VENTILATING MAGAZINE an account was given of a series of tests made in the Harris Trust & Savings Bank, in Chicago, on February 24 and 25, 1921, to determine the air conditions therein. This series we will speak of as Test No. 1.

As described in that issue, the original ventilating system was of the plenum type, supplemented by exhaust through registers in the ceiling and on the west wall. The air supply for the main banking space was principally from registers along the east wall about 8 ft. above the floor. This was supplemented by a supply at the south end of the west wall. In addition to the exhaust equipment previously mentioned an exhaust fan was located in a window frame in the south wall. With this equipment distribution was unsatisfactory and caused considerable complaint with regard to drafts and insufficient supply at various locations. No control of humidity was attempted.

During the summer and fall of 1921, alterations were made in the building and equipment for the purpose of giving more space and better banking facilities and to improve the heating and ventilation. The changes included the erection of additional balcony space, the installation of new elevators and rather extensive remodeling of the ventilating equipment. The old balcony extended along the south and east walls of the building only, with a small communicating passageway along the north wall. The alterations included extending the east balcony outward to the main columns of the building and the construction of a similar balcony along the west wall, also an extension of the passageway across the front of the building to form a good-sized balcony space in this location. An additional elevator was installed in the northeast section of the banking space.

NEW EQUIPMENT.

The present system, after remodeling, provided for supply about 8 ft. above the floor on the east, south and west sides of the building, with exhaust registers similarly located at the floor line. The supply and exhaust arrangement is practically the same in the entire balcony space, with the addition of some supply from "furred down" spaces between the columns. A clear idea of the arrangement can be obtained by referring to Figs. 1, 2, and 3. Fig. 1, being the first floor plan, Fig. 2, the balcony plan and Fig. 3, a cross sectional view.

New air washers were also installed of the Carrier type and the entire duct system, or those portions of the old system that were used in the remodeling scheme, were thoroughly cleaned and renovated.

The new temperature and humidity control equipment is the Carrier dew-point system. Duct-type thermostats are installed at the outlet of the washers,

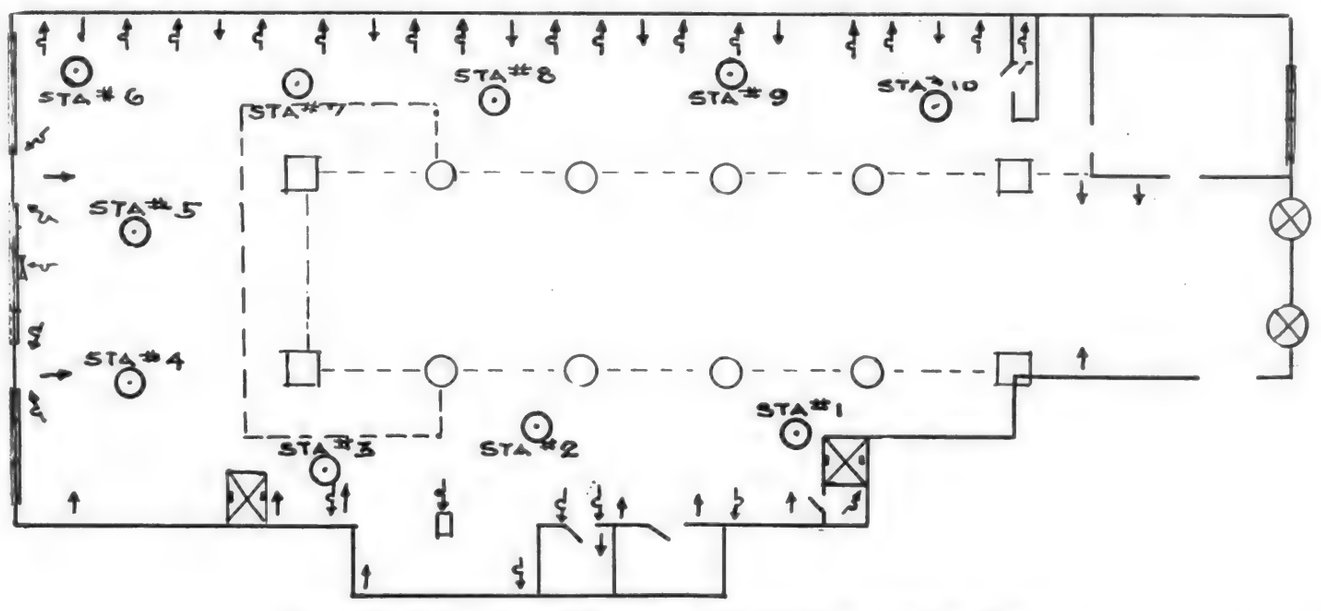


FIG. 1.—FIRST FLOOR PLAN, HARRIS TRUST BUILDING (SECOND TEST).

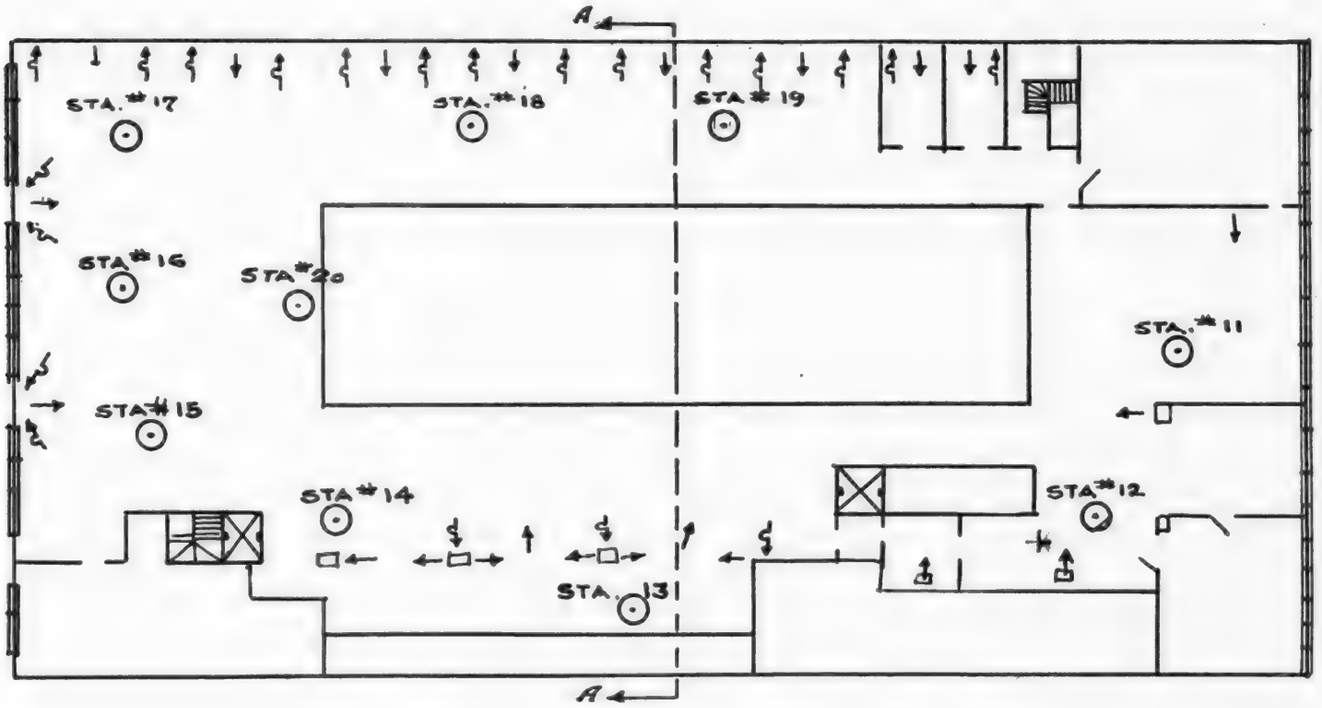


FIG. 2.—BALCONY PLAN, HARRIS TRUST BUILDING (SECOND TEST).

set at a pre-determined saturation temperature which will give the desired humidity when the air is raised to the temperature of the room. The thermostats were set at 44°. The reading of the duct thermostat from the air washer supplying the banking space at the time of the test was 42° and at the other washer 46°. These thermostats control valves from a steam line which operates to maintain a temperature of the water in the washers sufficient to saturate the air at the required dew-point temperature.

At the intake of each washer an additonal thermostat is provided for supplying steam to the tempering coils when the outside temperature falls below 30°. These thermostats are set at 30°. The duct thermostats control the moisture content of the air; the dry-bulb temperature is controlled by thermostats immediately beyond the re-heaters set at 58°. They operate the re-heaters and maintain a temperature of 58° of the air leaving the same. This system is supplemented by additional control from a room thermostat in the main banking space near station No. 10, which operates to supply additional steam to the re-heaters and bring the final temperature of the air entering the room to approximately 68°. In addition to the above some of the direct radiators beneath the windows are provided with thermostat control.

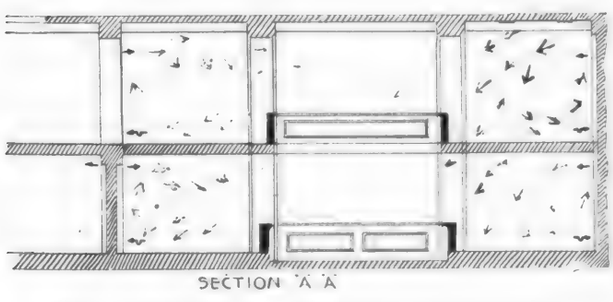


FIG. 3.—SECTION A-A, BALCONY FLOOR PLAN.

METHOD OF TEST.

The methods employed in making the test were as described in Test No. 1, namely, the location of stations at representative points and testing to determine temperature, both wet and dry-bulb, air motion, dust, bacteria and odors. Distribution is calculated from the variations in the carbon dioxide samples and charts plotted from the data thus secured. Charts were made from tests on the main floor, on the balcony, in the stenographers' room on the third floor and also in the Circulation Department and the Addressograph Room on the same floor.

The tests were started on March 13 with the mechanical equipment in full operation and all of the sprays in the air washer on. The dry-bulb readings on the main floor were from 73° to 75° at the 10 stations, averaging slightly over 74°. The wet-bulb readings ranged from 61° to 65°, with an average of 63.5°. On the balcony the dry-bulb readings ranged from 75° to 76°, with an average of 75.5° and the wet-bulb from 63° to 66°, with an average of 64.5°. The temperature in the balcony, both wet and dry-bulb were slightly higher than on the main floor, and all temperatures were much too high for comfort, the wet-bulb ranging from 8° to 10° above desirable. The maximum temperature outdoors on this date was 65°.

It was apparent from the temperature readings on this date that plotting charts under these conditions would give a false idea as to the operation of the equipment during cold weather, as the total heat of the air leaving the re-heaters exceeded the maximum amount allowed by the setting of the thermostats. The engineer was, therefore, instructed to operate the equipment in the same manner on the following day with the exception that all spray nozzles in the washers supplying the banking space were to be shut off, leaving the flooding nozzles only in operation. This would materially reduce the evaporation of the water in the

washer and consequently the relative humidity of the air.

Temperature readings were again taken on March 14 with sprays shut-off and these readings used in plotting the charts. On March 14 the dry-bulb temperatures in the main floor ranged between 69° and 70°, with an average of 69.8°, and the wet-bulb ranged from 55° to 56°, with one reading only of 57°. The average wet-bulb was 55.5°. The relative humidity was 40%. The average dry-bulb in the balcony was 71.8° and the average wet-bulb was 56.4°. The outside temperature on March 14 was as follows: Dry-bulb 49°; wet-bulb 41°.

MAIN BANKING SPACE, FIRST FLOOR (SEE CHART NO. 1)

This chart gives a final percentage of 95.1. The air conditions in general are very satisfactory and practically no complaint was heard from any of the employees. One or two instances were mentioned where objectionable drafts had been noted, but these in the majority of cases were corrected by the engineer of the building. It should be mentioned at this point that drafts due to excessive air action can be easily corrected by reducing the air volume as the entire amount of air entering the space is so abundant that a reduction of velocity at any of the register faces will not interfere with the air conditions as a whole.

The distribution was the least satisfactory of all the factors and even this was 91%. It should be borne in mind that a large space like the main floor of this building, opening directly on to the street and frequented by the public, is a very difficult space in which to obtain perfect distribution. Considering the difficulties to be encountered in a space of this character the distribution factor of 91% is very satisfactory.

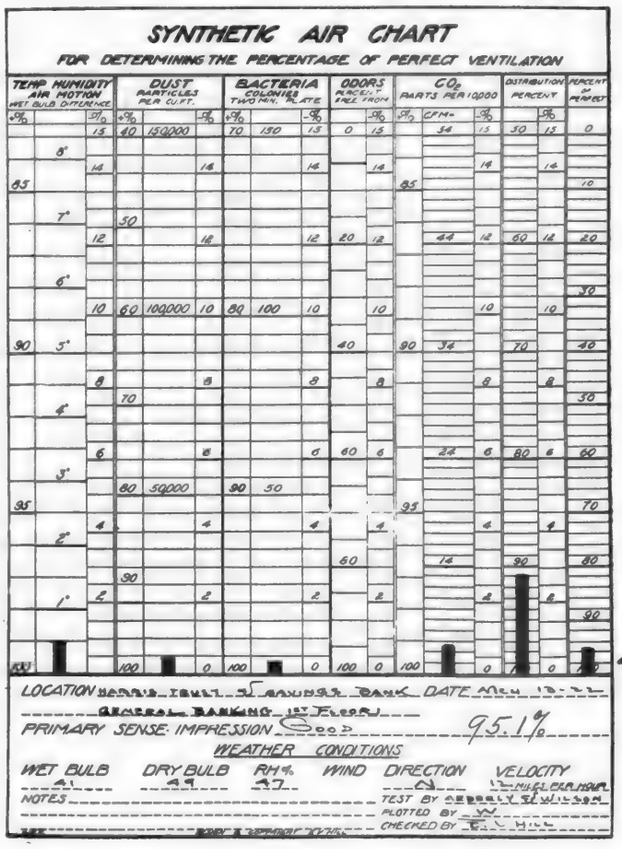
The dust count in this space averaged 4,060 particles which contrasts very favorably with the dust count of 16,140 in the test before the equipment was remodeled.

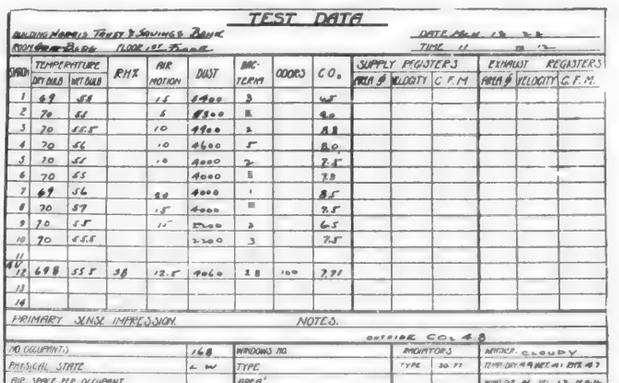
BALCONY (SEE CHART NO. 2)

The final percentage in the balcony was 93.5, the important penalization factors being in this case the distribution and the slightly excessive wet-bulb temperature. The distribution was 91.5% and the wet-bulb 56.4°. For the air motion in the balcony the wet-bulb should have been 55°. The same low dust and bacteria counts were found as on the main floor. Complaints were received regarding objectionable drafts in one or two locations, particularly near station No. 16 and another at station No. 19. These conditions were corrected at station No. 19 immediately following the test and probably the condition at station No. 16 has also been corrected by this time. It was only necessary to reduce the velocity at the register faces or deflect it so that it takes a higher course from the register.

STENOGRAPHIC ROOM (SEE CHART NO. 3)

This test gave a final percentage of 90.4, the penalization being caused by a high temperature. The average wet-bulb was 58.6°, or 3.6° above desirable. The excessive temperature in the stenographic room is

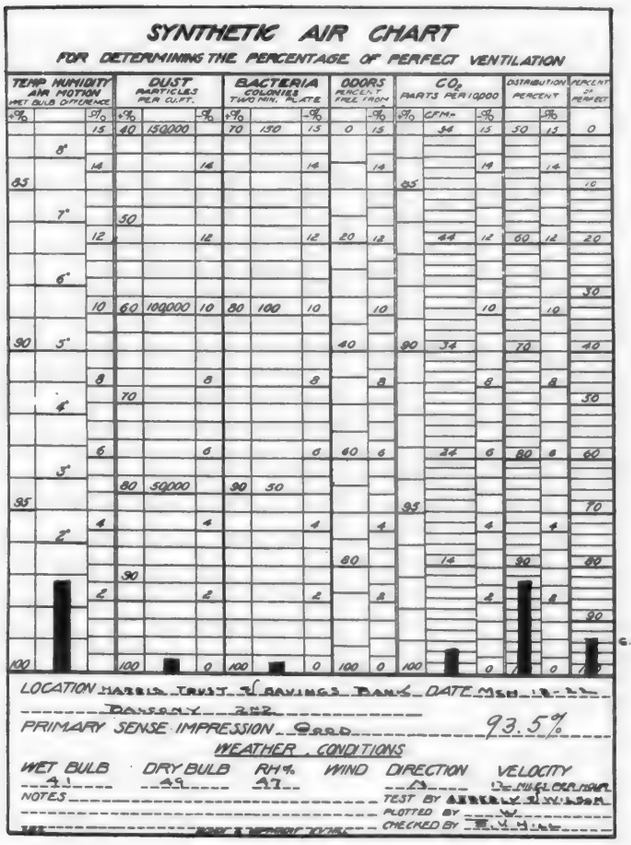


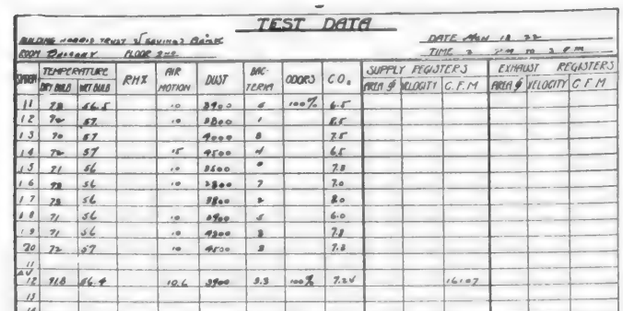


RESULTS OF SECOND TEST IN MAIN ROOM, FIRST FLOOR, HARRIS TRUST BUILDING.

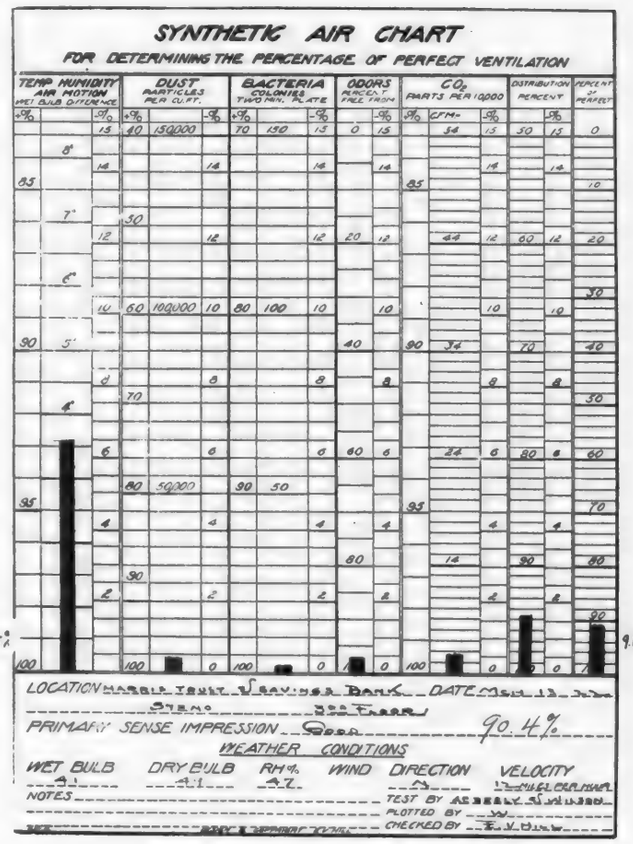
partly to be accounted for by the small amount of exposure in this room, the large number of occupants per unit of space than is found in other portions of the bank and the insulating sound deadening material on the ceiling. There are two other factors, however, that are possibly more important. Heat from the engine and boiler rooms passing up through the wall space at the west side of the stenographic room operates to increase the temperature. Some heat also ascends the elevator shaft and enters the stenographic room from this location through the open entrance doors.

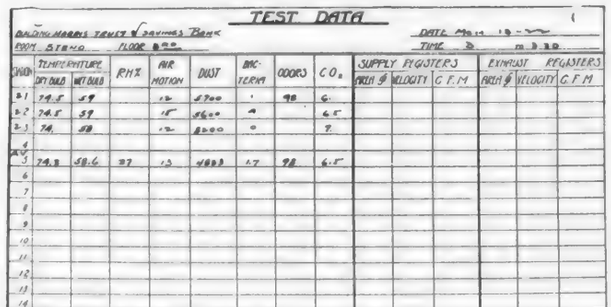
As the temperature of the air supply to the stenographic room is controlled by the thermostatic system previously described, and not from the room itself, it is a somewhat difficult matter to correct the condition, unless the heat from the engine and boiler rooms can be diverted. The final test, however, was above


SYNTHETIC AIR CHART
FOR DETERMINING THE PERCENTAGE OF PERFECT VENTILATION
LOCATION HARRIS TRUST & SAVINGS BANK DATE MCH 13-22
BALCONY 2ND
PRIMARY SENSE IMPRESSION Good 93.5%
WEATHER CONDITIONS
WET BULB 41 DRY BULB 49 RH% 47 WIND DIRECTION S VELOCITY 12 MILES PER HOUR
NOTES
TEST BY ASHERLY WILSON
PLOTTED BY W
CHECKED BY E.V.W.



Balcony, Second Floor.


SYNTHETIC AIR CHART
FOR DETERMINING THE PERCENTAGE OF PERFECT VENTILATION
LOCATION HARRIS TRUST & SAVINGS BANK DATE MCH 13-22
STENO 3RD FLOOR
PRIMARY SENSE IMPRESSION Good 90.4%
WEATHER CONDITIONS
WET BULB 41 DRY BULB 49 RH% 47 WIND DIRECTION S VELOCITY 12 MILES PER HOUR
NOTES
TEST BY ASHERLY WILSON
PLOTTED BY W
CHECKED BY E.V.W.



Stenographers' Room, Third Floor.

RESULTS OF SECOND TEST IN HARRIS TRUST BUILDING.

90%, as compared with a percentage of less than 87% before the equipment was remodeled. The employees in the room in general and the lady in charge testified to the material improvement of air conditions in the same.

CIRCULATION DEPARTMENT

The final percentage in this room was 91.35 which could be brought well above 95% by a reduction in the wet-bulb temperature. The other factors were consistent throughout with the conditons in the other rooms previously described.

ADDRESSOGRAPH ROOM

The final percentage in this room was 95.2 and the general impression good. A slight odor of ink or printing materials was present, which appears, however, to be in no way objectionable. The wet-bulb temperature was 56°, which was the lowest of any room in the test with the exception of the general banking space on the main floor.

DISCUSSION

In analyzing the data of Test No. 2, it is suggested that the reader review "Temperature Conditions and Drafts" as reported in connection with Test No. 1, and also "Conclusions," as it was here pointed out why the wet-bulb temperature is of importance in maintaining comfortable air conditions.

In Test No. 2, on March 13, the wet-bulb ranged from 8° to 10° above desirable. The thermostats located in the main banking space maintained a dry-

bulb temperature of approximately 68°. The dew-point thermostat in the duct is set at 44°. This should give a relative humidity in the banking space of approximately 42% and a wet-bulb temperature of approximately 55°. If, however, the outside dew-point temperature is above 44°, the air passing through the washer will be saturated at a higher temperature and the dew-point thermostat becomes inoperative.

In other words, the dew-point thermostat controls when the outside dew-point temperature is below 44°, but not when it is above. These conditions will arise at certain times during the Spring and Fall and the engineer must clearly understand that at these times the sprays in the washer must not be in operation, as the additional amount of moisture added to the air increases the wet-bulb temperature above the point of comfort. Objection might be raised to shutting off the spray nozzles under the impression that the washer so operated would be inefficient in dust removal. It can be clearly demonstrated, however, that over 90% of the efficiency of a washer in dust removal depends upon the eliminator plates, provided they are properly flooded, and not the operation of the spray nozzles. Properly flooded eliminator plates are all that is necessary to obtain efficient dust removal.

It is well to mention here that Test No. 1, was made under favorable conditions for a ventilating equipment not provided with humidity control, as the outside temperature and humidity was such that when the air was raised to the temperature maintained in the building a fairly satisfactory wet-bulb was obtained.

Test No. 2 was conducted under very similar weather conditions, but with a mechanical ventilating equipment which includes both temperature and humidity control. This system shows up to the best advantage when artificial humidification is necessary and not under moderate weather conditions where the outside temperature may be above the control point of the apparatus. At these times, a few days possibly during the Spring and Fall, the engineer must use extreme diligence and care in the operation of the equipment. It is highly desirable, at such times, that he have accurate wet-bulb readings throughout the ventilated space, several times each day.

On the balcony, near station No. 14, some complaints were received regarding the temperature. The readings, both wet and dry-bulb, in this location were not materially different from other stations in the vicinity and it is apparent that the condition is due to radiant heat from the chimney leading from the boiler room. If this is sufficient to require further treatment it is suggested that additional insulating covering be provided, or mechanical means for increasing the air motion in this space be adopted. Two or three circulating fans properly located would in all probability correct the difficulty.

HEAT FROM THE BOILER ROOM

This subject was mentioned in discussing the chart of the Stenographic Room. There is some difficulty to be expected from excessive heat from the boiler and engine rooms, not only in the stenographic room but in the main banking space as well. This may be more objectionable in warm weather and its correction appears to lie in the installation of proper exhaust equipment for the boiler and engine rooms, details of which should be worked out by the engineer of the building.

In conclusion, a few comparisons may be of interest. The average of all the charts in Test No. 1, excluding the private rooms, made under favorable conditions for the old equipment was 89% plus. The total percentage of all charts for the new equipment, tested, under rather unfavorable conditions, was 93.3. The average of dust counts in Test No. 1, was 17,453 particles per cubic foot. The average dust count with the new equipment was 4,022. With a little additional adjustment and attention it is probable that the final percentage in all the spaces ventilated at the present time can easily be brought to 95.

RECOMMENDATIONS.

1. That wet-bulb thermometers be placed in suitable locations throughout the space occupied by the bank, two on the main floor, two on the balcony and one in the stenographic room, and that some employee in the neighborhood of each instrument be detailed to take readings three or four times daily of the wet-bulb temperature, this to be made a matter of record and the information supplied to the operating engineer.
2. The engineer to be instructed to shut off the spray nozzles of washer, whenever the wet-bulb temperature goes above 56° in cold weather and 60° in warm weather.
3. That two 12in. or 14in. circulating fans be provided in the vicinity of station No. 14 to increase the air motion.
4. That a study of air motion, particularly with references to drafts, be made throughout the banking space next winter when the outside temperature is below 20° and that further minor adjustments of distribution be made.

With these minor changes, the writer is of the opinion that the equipment will prove entirely satisfactory.

The Factor of Heating in the Super-Power Plant

One more contribution to the debate on the central power plant versus the isolated plant is contributed by Egbert Douglas, writing in *Industrial Management* for November, 1922. Mr. Douglas analyzes the coal conservation arguments in the project for the gradual elimination of the small steam plant and the development of super-power projects and asks, "How about coal for heating?" In many factories, he shows, power is produced as a by-product of heating operations.

As Mr. Douglas points out, the 28% of the coal used by the industries, other than steel and coke plants, is not all used for power purposes. A large part of it is used for heat, which is just as essential as power. Heat and power are so interwoven that both can, and should be, produced, in many instances, from the same boilers and with the same coal. If one-half of the coal used by the group of industries making up 28% of our consumption is for heat, there remains an item of only 14% for the central stations to work on. This in quantity is about equal to our consumption for domestic purposes, which are used entirely for heating.

Mechanical Equipment for A Large Mesaba Iron Range School

Northwestern Practice Illustrated in the Remarkable Plant Installed in the Vocational High School at Virginia Minn.

II.

(Concluded from November issue)

SUPPLY units No. 9, 10, 11, and 12 and connecting systems of distribution for the classrooms are of same size, are symmetrically located, and except for variations of flue locations, are alike in all respects.

Units are located in tunnels No. 2 and 3, directly under main entrances. Air is drawn in at the roof and, together with return air, when such is used, is drawn down air-intake shaft to the air-intake chamber. From the fan the air is discharged through a vertical riser to a system of galvanized-iron ducts, located in furred space over ground-floor corridor, with connections to vertical flues leading to the various openings in the rooms. Natural exhaust is provided through vent openings in the rooms connected to vent risers leading to furred space over third-floor corridor and connected to a horizontal vent duct leading to outlet openings through roof ventilators.

TOILET EXHAUST.

Two exhaust fans of equal capacity are located in equipment room No. 1A at the top of the building. From these fans two systems of galvanized-iron ducts similar as to arrangement and size provide connections for boys' and girls' toilet rooms, locker rooms, shop toilet and locker rooms, and janitor's closets adjacent to toilet rooms.

The main toilet rooms are equipped with an arrangement of galvanized-iron ducts extending from inlet grilles at floor to corridor and extending up to and across ceiling of toilet room in furred beam, with outlet in side of same to toilet room. All other enclosed locker rooms, janitor closets, etc., have grilles built into the panels of the doors leading to same.

The purpose of these arrangements is to provide a continuous movement of air from the corridors and other rooms having supply ventilation through the toilet and other rooms, thus preventing all possibility of odors from these rooms penetrating other parts of the building.

To insure the free circulation of air all closet fixtures are provided with grilles behind them and all urinals are of the ventilated type with individual connections from each to the main system of exhaust ducts, thus insuring a strong current of air passing through same at all times.

LOCKER VENTILATION.

All lockers throughout the building are arranged for mechanical exhaust ventilation with galvanized-iron ducts connecting same to the various exhaust systems, as already noted. Lockers are arranged in single and double rows and in single and double tiers. Single tier lockers are placed against walls or back to back. Double tier lockers are set 4 in. from wall for single row or with 4-in. space between rows for double row, to afford ventilation of lower tier of lockers.

All lockers are of metal and provided with louvre opening in bottom of doors to afford inlet of air. Exhaust opening for each locker is 3 in. in diameter and located in top of single lockers and top tier of double tier lockers with 3-in. opening at back of lower tier of double tier lockers near top.

Exhaust chambers are provided at top of each group of lockers, integral with same and extending full length, to which exhaust connection is made to air-conveying systems. Chambers for single-tier, single-row lockers are full depth of lockers; for single-tier, double row, full depth of double lockers, and for double-tier, full depth of lockers and 4 in. chamber for lower lockers. All chambers are 12 in. high. Partitions are provided in chambers separating locker units by rows and tiers, forming two chambers for single-row, double-tier, and three chambers for double-row, double-tier.

TEMPERATURE CONTROL.

A complete system of automatic temperature and humidity control has been installed in connection with the ventilating system the details of which are to be described later.

The Heating System

The entire building, with the exception of corridors, is heated with direct radiation with ventilation provided for all of the rooms. The corridors are heated with the plenum system of indirect heating in connection with the ventilating system. This latter arrangement was made in order to avoid the use of unsightly radiators under the windows of the three light courts.

The question of the method of steam supply for the building received considerable attention from all parties interested. The Board of Education had in mind at the beginning the erection of a boiler plant for the purpose of providing steam for the new building, together with the old Technical School and the Roosevelt School. With this point decided upon, the engineers prepared a complete report on the advisability of the board also building an electric power plant to furnish current for lighting the building and power for operating the various electric motors of which there is a total of 625 connected horse-power.

In order to arrive at the best method of procedure to secure the most economical arrangement the engineers prepared a comprehensive report of the operation of the entire equipment. This report included in all about 100 tables of figures. The conclusion was that the most economical arrangement would be a private generating plant using the city part-time service for night load on Sundays and holidays. On this basis, steam could be manufactured for 55c per 1000 lbs. at pre-war prices of $4.42 per ton and at 74c per 1000 lbs. at war prices of $7.27 per ton of coal and the electric plant would pay 14.1% interest on the extra investment required with coal at pre-war prices, or 11.7% interest at war prices.

The building of this boiler and electric plant by the school board did not work in well with the plans of the city for the construction of a new central heating and power station, wherefore the city submitted a favorable proposition to the effect that they be permitted to build an additon to their present power plant and furnish steam to the board at cost. This was accepted and the installation of main lines and piping planned accordingly. The cost to the board for steam last year was at an average of 70c per 1000 lbs. and electric current is provided at an average cost of 2¼c per K. W.-hour.

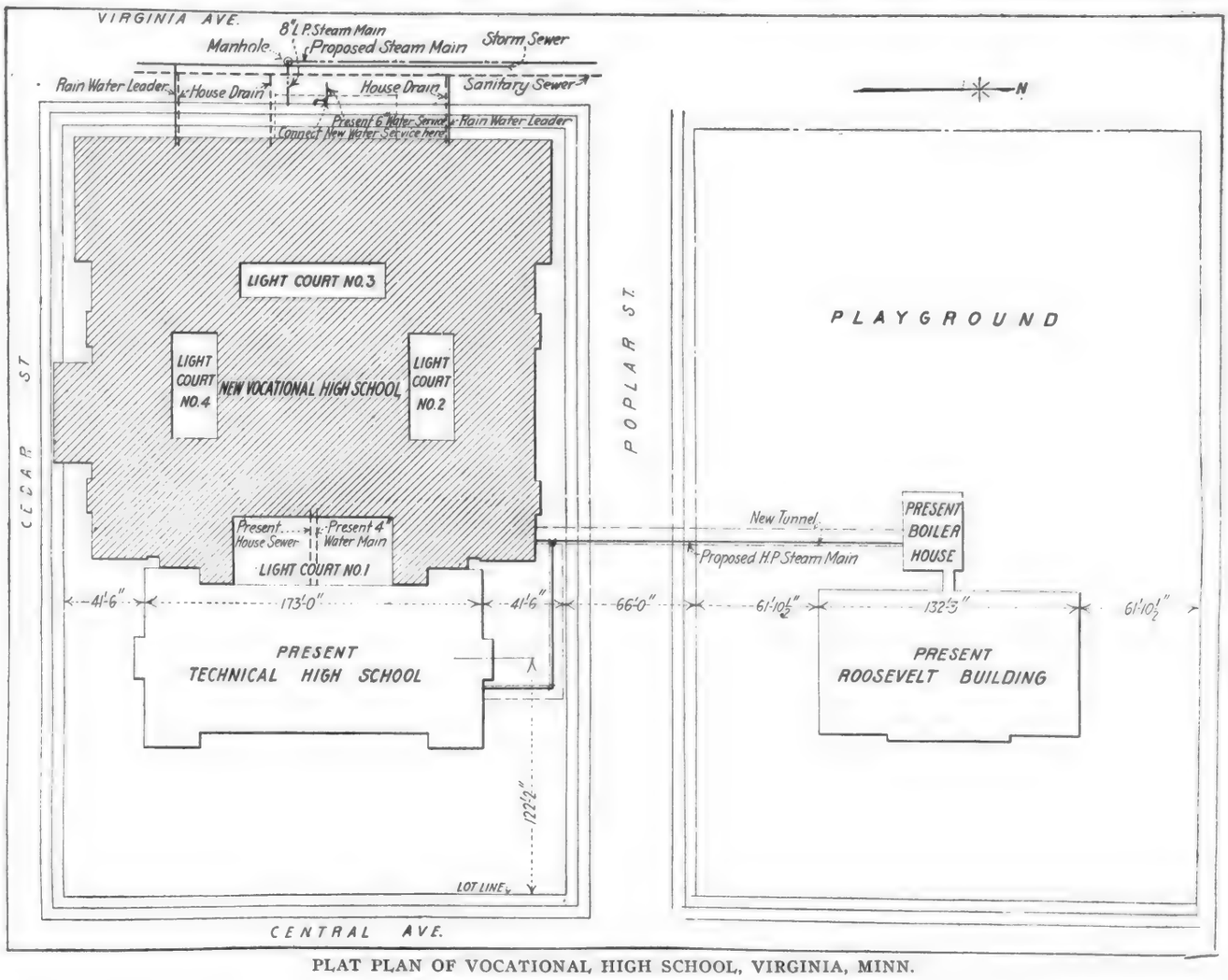
The new city power plant of Virginia is located on Virginia Avenue, approximately 700 ft. west from the west lot line of the new building on the opposite side of the avenue. From this power plant a 10-in. high-pressure line conveying steam at 70 lbs. pressure and a 10-in. low-pressure line with steam at 2 to 5 lbs. pressure extend in conduit under the street, with connections to all three buildings.

The direct radiation and indirect radiation for the ventilating system is connected by a two-pipe vacuum system of heating, the water of condensation being returned through two independent systems of vacuum returns, each connected to a steam-driven and an electrically-driven vacuum pump, cross-connected and arranged to discharge through air separating tanks to "V"-notch recording meter with gravity return to power plant from meter through underground return main.

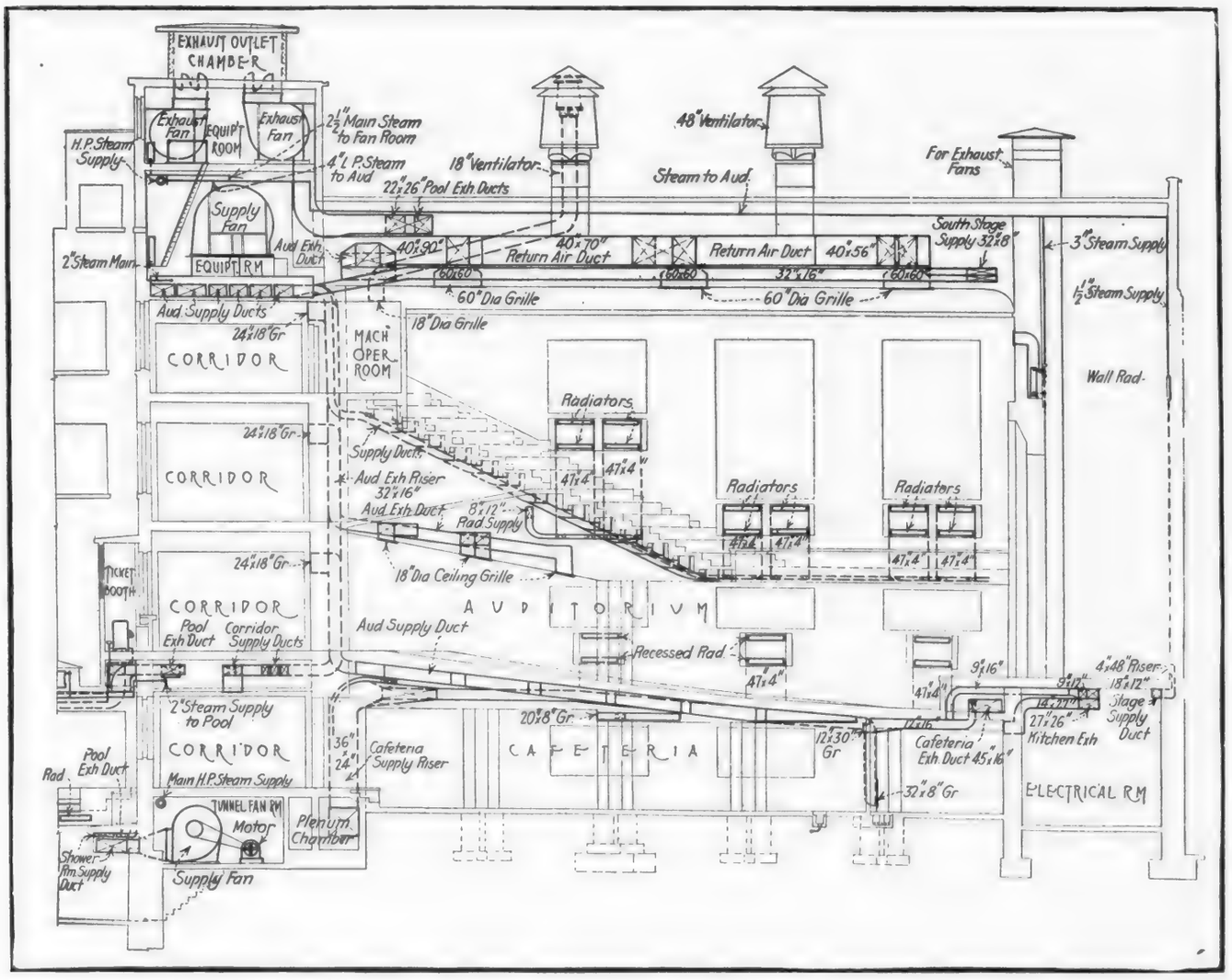
Like the ventilating system the steam distributing system has been designed so as to be in harmony with the operating requirements of the various departments or sections throughout the building. Independent supply and return mains, or branch mains from main supply and return mains have been provided for direct radiation, and for indirect radiation, in connection with each section of the building and have been so valved and controlled that any one unit or section may be shut off without in any way affecting the operation of the balance of the system.

HEATING THE SHOPS.

A low-pressure system of steam distribution has been



PLAT PLAN OF VOCATIONAL HIGH SCHOOL, VIRGINIA, MINN.



SECTION THROUGH AUDITORIUM, VOCATIONAL HIGH SCHOOL, LOOKING SOUTH AT CENTER LINE OF BUILINDG.

provided in connection with the direct radiation and the indirect radiation for the shops. This arrangement was provided to utilize a considerable amount of exhaust steam available at the power plant for several hours during each day of the winter term of school. Live steam is admitted to the line through pressure-reducing valve located in the power plant, whenever there is an insufficient amount of exhaust steam to supply the demand.

For all other sections of the building steam is distributed at high pressure to various distributing centers or tees, from which connections are taken for direct radiation and for indirect radiation in connection with each of the various sections of the building. Each connection from high-pressure main, or "distributing center," is provided with pressure-reducing valve and three valve by-pass. Steam is reduced to 5 lbs. gauge pressure for indirect radiation and to 1 lb. gauge pressure for direct radiation.

At the point where the high-pressure line enters the building a pressure-reducing valve is provided for reducing to 45 lbs. gauge pressure for distribution in building. This valve is provided with a full size by-pass for low-pressure summer service. From this point two main lines are taken, one line to lead to distributing centers and direct service tees on south and east sides of the building, and one line to serve north and west sides of the building.

The high-pressure piping is very carefully planned with expansion bends, anchors, roller supports, hangers, and drip connections wherever necessary. Also all flange connections are so arranged as to be easily accessible for repairs.

All high-pressure drips connect to a system of high-pressure returns leading back to and discharging into the side of "V"-notch meter.

Each steam-driven vacuum pump has 2-in. exhaust pipe rising to roof with 2-in. exhaust head and an oil separator, a by-pass to low pressure main leading to class rooms, and a back-pressure valve installed in line.

Direct connections from high-pressure mains are made to domestic water service heaters, vacuum pumps, kitchen equipment, and glue room equipment.

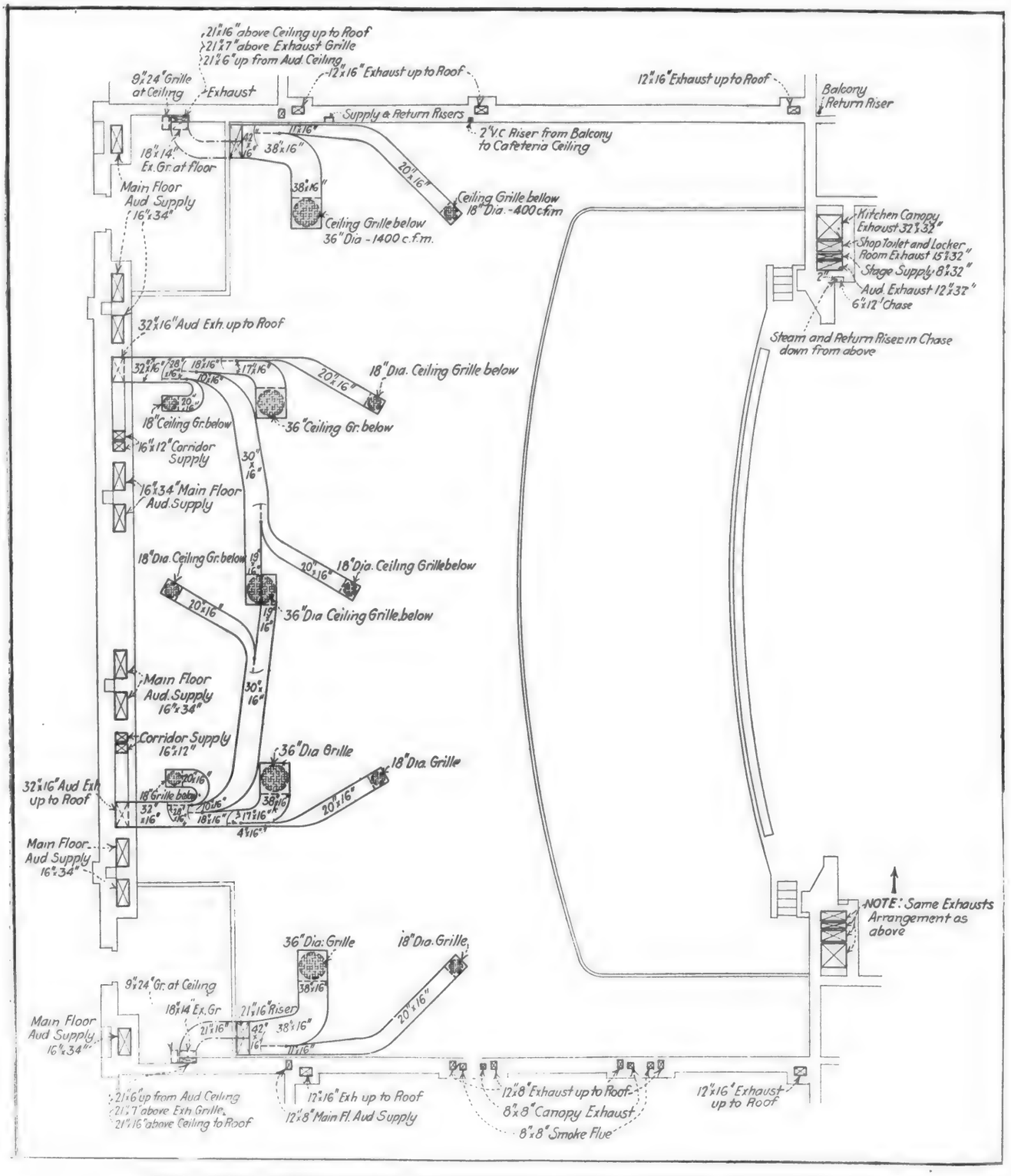
At all points of the piping system where pockets are formed, at end of all steam mains, at various points on the lines, and for all equipment requiring steam service connections for heating, drip connections are provided. Low-pressure drips are connected to vacuum returns through thermostatic traps. High-pressure drips are connected to a system of high-pressure returns through independent steam traps provided with three valve by-pass and discharging to "V"-notch re-

cording meter, receiving discharge from vacuum pumps.

ARRANGEMENT FOR USE OF EXHAUST STEAM DURING SUMMER MONTHS.

To utilize the maximum amount of exhaust steam available at the power plant during the summer months it is the intention to circulate steam at low pressure through the entire piping system during this period. To provide for this alternative method of operation, all high-pressure steam supply piping has been made sufficiently large to carry maximum low-pressure summer load. High-pressure drip connections of domestic water service heaters have been provided with secondary by-pass connections to high-pressure return through controlling valves and low-pressure thermostatic traps. Also main high-pressure return is provided with special by-pass connection through controlling valve to vacuum returns mains to vacuum pumps in equipment room No. 7.

Distributing center for shops is low-pressure inas-


21"x16" above Ceiling up to Roof
21"x7" above Exhaust Grille
21"x6" up from Aud. Ceiling
9"x24" Grille at Ceiling
Exhaust
12"x16" Exhaust up to Roof
12"x16" Exhaust up to Roof
Balcony Return Riser
Supply & Return Risers
2" V.C. Riser from Balcony to Cafeteria Ceiling
18"x14" Ex. Gr. at floor
Main Floor Aud Supply 16"x34"
Ceiling Grille bellow 18" Dia. - 400 c.f.m.
Ceiling Grille below 36" Dia - 1400 c.f.m.
Kitchen Canopy Exhaust 32"x32"
Shop Toilet and Locker Room Exhaust 15"x32"
Stage Supply 8"x32"
Aud. Exhaust 12"x32"
6"x12" Chase
32"x16" Aud Exh. up to Roof
Steam and Return Risers in Chase down from above
18" Dia. Ceiling Grille below
18" Ceiling Gr. below
36" Ceiling Gr. below
16"x12" Corridor Supply
16"x34" Main Floor Aud. Supply
18" Dia. Ceiling Gr. below
18" Dia. Ceiling Grille below
36" Dia Ceiling Grille below
Main Floor Aud. Supply 16"x34"
Corridor Supply 16"x12"
36" Dia Grille
18" Dia. Grille
32"x16" Aud Exh up to Roof
Main Floor Aud Supply 16"x34"
NOTE: Same Exhausts Arrangement as above
36" Dia. Grille
18" Dia. Grille
9"x24" Gr. at Ceiling
18"x14" Ex. Gr
21"x16" Riser
Main Floor Aud Supply 16"x34"
21"x6" up from Aud Ceiling
21"x7" above Exh. Grille
21"x16" above Ceiling to Roof
17"x16" Exh up to Roof
12"x8" Main Fl. Aud Supply
12"x8" Exhaust up to Roof
8"x8" Canopy Exhaust
8"x8" Smoke Flue
12"x16" Exhaust up to Roof

PLAN ABOVE FURRED CEILING UNDER BALCONY FLOOR, VOCATIONAL HIGH SCHOOL.

much as the service at this point is low pressure at all times.

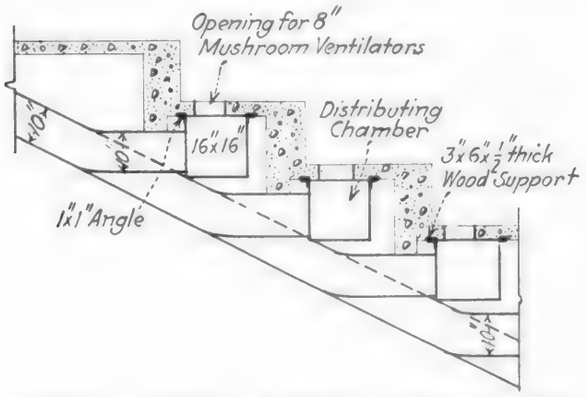
Distributing centers have been assigned numbers for designation. The number assigned to each is marked on the plans and is as follows:

		LOCATION.
No. 1-A	—Auditorium direct	Equipment Rm. No. 1
No. 1-B	—Auditorium indirect—north	Equipment Rm. No. 1
No. 1-C	—Auditorium indirect—south	Equipment Rm. No. 1
No. 2	—Shop Low Pressure	Equipment Rm. No. 13
No. 3-A	—Boys' Gymnasium—indirect	Equipment Rm. No. 3
No. 3-B	—Boys' Gymnasium—direct	Equipment Rm. No. 3
No. 4-A	—Girls' Gymnasium—indirect	Equipment Rm. No. 4
No. 4-B	—Girls Gymnasium—direct	Equipment Rm. No. 4
No. 5	—Caféteria—indirect	Tunnel No. 1 North
No. 6-A	—Pool—indirect	Tunnel No. 1 South
No. 6-B	—Pool—direct-north	Equipment Rm. No. 7
No. 6-C	—Pool—direct-south	Equipment Rm. No. 8
No. 7	—North Corridor—indirect	Tunnel Rm. No. 1 North
No. 8	—South Corridor—indirect	Tunnel No. 1 South
No. 9-A	—Northeast Cl. Rm.—ind.	Equipment Rm. No. 9
No. 9-B	—Northeast Cl. Rm.—direct	Equipment Rm. No. 7
No. 10-A	—Northwest Cl. Rm.—ind.	Equipment Rm. No. 10
No. 10-B	—Northwest Cl. Rm.—direct	Equipment Rm. No. 10
No. 11-A	—Southeast Cl. Rm.—ind.	Equipment Rm. No. 11
No. 11-B	—Southeast Cl. Rm.—direct	Equipment Rm. No. 8
No. 12-A	—Southwest Cl. Rm.—ind.	Equipment Rm. No. 12
No. 12-B	—Southwest Cl. Rm.—direct	Equipment Rm. No. 12
No. 13	—Conservatory—direct	Equipment Rm. No. 11

Low pressure steam and vacuum return piping consists of independent circuits of piping leading from and returning to each distributing center, with supply and return connections to each radiator in the section of the building referred to.

Low pressure for steam and return piping for indirect radiation consists only of a short extension of the main lines from distributing centers as same are located within a short distance from each ventilatng unit.

All condensation from direct and indirect radiation drains to each pair of vacuum pumps in equipment rooms No. 7 and 8 through special lift connection at pumps. Each branch line from direct radiation, indirect radiation, or other equipment is provided with controlling valves at connection to main.

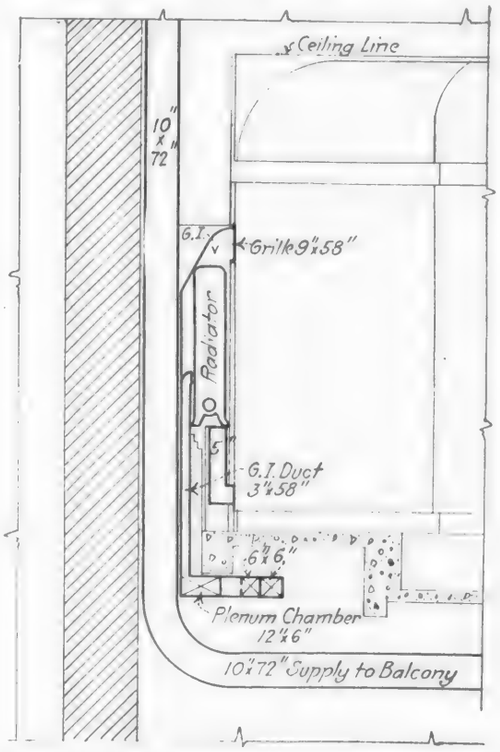


SECTION THROUGH BALCONY FLOOR SHOWING ARRANGEMENT OF DISTRIBUTING CHAMBERS FOR MUSHROOM AIR DIFFUSERS.

Each pair of steam and electric-driven vacuum pumps are cross-connected and arranged to discharge through single line through automatic controlled vent, air separating tanks, suspended from ceiling directly over pumps, to "V"-notch recording meter, provided with gravity drain to power plant.

For the old Technical Building a new steam connection is taken from the high-pressure main through pressure-reducing valves provided with by-pass and separate connections made to direct and indirect piping of old system. The condensation from direct radiation is arranged to drain back to the new vacuum pumps, but as the indirect radiation is at too low an elevation to secure drainage back to the vacuum pumps vertical condensation pumps have been installed with discharge connections leading to the "V"-notch recording meter.

The heating system of the Roosevelt building has been remodelled to accommodate the new arrangement. New lines connect the old piping to the new high-pressure line and a recording meter is provided for measuring the water of condensation, with gravity connection from meter to new 5-in line draining back to power plant from meter in new building.



ENCLOSED RADIATOR IN AUDITORIUM FLUE WALL.

THE DOMESTIC HOT WATER SERVICE.

Hot water for domestic service is furnished from seven centers, which have been given a number of designation as follows:

Center No. 1—Equipment Room No. 13, serving fixtures in gymnasium shower and locker rooms, and shops.

Center No. 2—West end of tunnel No. 2, serving domestic science, north general kitchen, north shop toilet, lavatories in rooms Nos. 11, 116, 216 and 315 and slop sinks in Nos. 115 and 215.

Center No. 3—West center of tunnel No. 3, serving dairy room, south general kitchen, horticulture and forestry rooms, conservatory, south shop toilet, lavatories in rooms Nos. 25, 126 and 226, and slop sinks in Nos. 129 and 227.

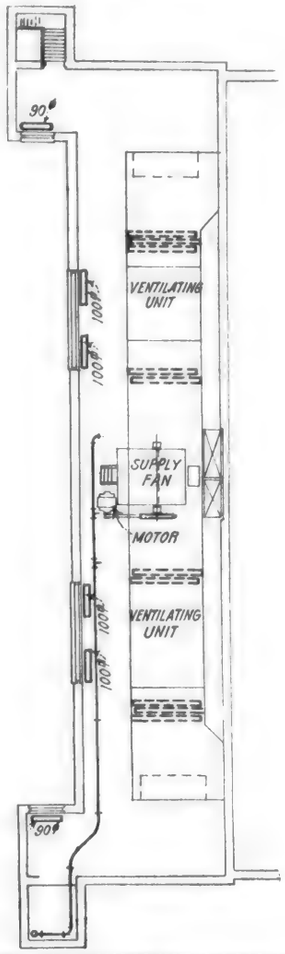
Center No. 4—Equipment room No. 6, north, serving fixtures in girls' shower room of pool.

Center No. 5—Equipment Room No. 6, south, serving fixtures in boys' shower room of pool.

Center No. 6—Equipment room No. 7, serving fixtures in girls' toilets, adjacent janitors' closets and teachers' wash rooms, all floors, and south distribution

Center No. 7—Equipment Room No. 8, serving fixtures in boys' toilets, adjacent janitors' closets and teachers' wash rooms, all floors, and south distribution manifold of technical building.

Water is heated by steam, and for centers Nos. 2, 3, 6, and 7, storage tanks with self-contained steam coils are used and for centers 1, 4 and 5, storage tanks with independent steam service heaters.



PLAN OF EQUIPMENT ROOM NO. 1-A.

From these heaters hot water supply mains and return circulation mains are extended to connect with all fixtures in the various centers as noted above.

AUTOMATIC TEMPERATURE CONTROL SYSTEM.

A complete system of automatic temperature control has been installed in the building, in connection with the various independent units of ventilation and heating, as hereinbefore described.

The system operates with compressed air and consists of the necessary thermostats, single and louvre dampers, diaphragm motors for operating the dampers, diaphragm valves for indirect and direct radiation together with necessary galvanized piping.

Compressed air for operating this system is taken from two air-storage tanks located in equipment rooms Nos. 3 and 4. Air is delivered to the air-storage tanks from the high-pressure air supply system for the building through pressure-reducing valves. The pressure in the air storage tanks is maintained automatically at 15 lbs. gauge.

The direct radiation in the rooms is controlled by means of positive-action thermostats so located as to best serve the purpose for which they are intended, and arranged to operate the diaphragm valves on the radiators.

The various ventilating systems for the building are so designed that for all outdoor temperatures below 70° F. the air delivered to the rooms may be maintained at a constant temperature of 68° F. and 40% relative humidity. Sufficient indirect radiation has been provided in connection with each unit of ventilation to heat the air to the above temperature in the coldest outdoor weather.

The first section of the primary radiation is not controlled. The second and third sections are controlled by a two point perforated tube-type thermostat, located in chamber between air washer eliminators, and secondary radiation, and connected to operate the diaphragm valve in connection with each section. Installed in this same chamber also is a "dew-point" thermostat connected to operate the mixing valve in connection with the humidity control heater of the air washer. The dew-point thermostat is set at 43° F., which is the dew-point temperature of the air. The thermostats controlling the second and third sections of primary radiation are set at 41° and 39° respectively. The purpose of this control is to maintain a constant temperature of the saturated air leaving the air washer at 43° F.

The temperature of the tempered air as delivered to the rooms is controlled by a three-point multiple thermostat located in the fan discharge for each unit and connected to operate the diaphragm valve in connection with the secondary indirect radiation and the by-pass dampers under same. The two points controlling the valves are positive in action and are set for 74° and 70°, respectively, with the one for the by-pass damper set for 73°. The purpose of this control being to maintain a constant temperature of 73° for the air leaving the fan. It is estimated that there will be an approximate loss of 5° in the air conveying system before the air is finally discharged to the rooms. Variations for temperature in the different rooms are taken up with the direct radiation set to maintain the constant temperaure of 68°.

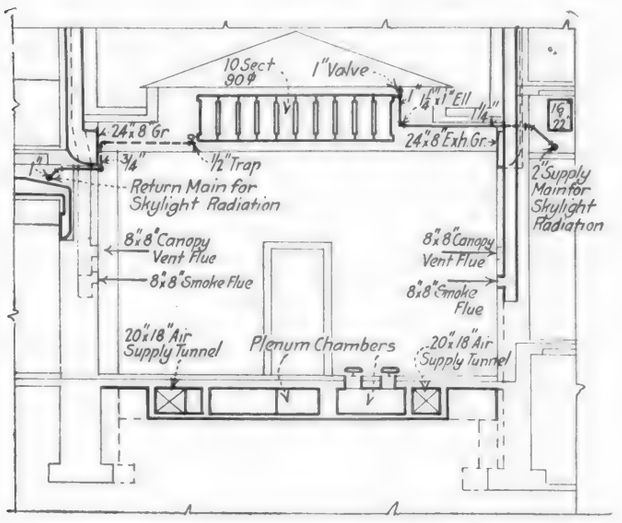
The systems in connection with the ventilating units Nos. 1, 3, 4, 9, 10, 11 and 12, are so arranged that for all outdoor temperatures of 40° F., and below, a sufficient portion of the air may be recirculated to maintain the constant dew-point temperature of the air leaving the air washer, without admitting any steam to the tempering coils except in extremely cold weather, when the first section would be put into service.

The necessary control for this arrangement is provided in addition to the control provided for the primary radiation as hereinbefore described. This consists of a three-point multiple thermostat, all points with intermediate action. The thermostat is located in the fresh-air chamber of each unit and connected to operate the dampers in the fresh-air intake, return-air connection to same and in the main vent connection from vent chambers. All points of thermostats are set at 40° F. As it would not be desirable to circulate a

greater portion than 75% return air, stops are provided in the connection with the fresh-air and return-air dampers at the proper location to prevent an excess of return air. With this method of control any necessary additional heating of the air is supplied by heating the water circulated for the air washer, still maintaining the constant dew-point temperature of the air leaving the washer.

In connection with each of the units provided with return-air system there are five pneumatic switches mounted on oak switch panels. One 3-way switch closes air to three-point thermostat operating fresh-air, return-air, and vent dampers, and opens air to three switches for independent control of the dampers. The fifth switch controls air supply to two-point thermostat controlling primary radiation.

For controlling reheater indirect radiation in connection with ventilating units No. 7, and 8, a three-point multiple thermostat is located in the fresh-air intakes, and connected to operate the diaphragm valves



CROSS SECTION OF ROOM NO. 17, SHOWING ARRANGEMENT OF SKYLIGHT RADIATION.

in connection with each section. One point is set for 60°, one at 40°, and one at 20°, controlling third, second, and first sections, respectively.

For controlling the reheater radiation in connection with ventilating unit No. 1 there are intermediate-action room thermostats located on the walls, one at each side of the stage, and connected to operate the mixing dampers.

For maintaining a constant temperature of 68° in the corridors, domestic science room, and dairy rooms, intermediate-action thermostats are located on the walls at locations where they will best serve the purpose for which they are intended, and connected to operate the mixing dampers at the plenum chambers.

In addition there are pneumatic switches to control all exhaust fan discharge dampers, fresh-air intake dampers for units Nos. 2-A, 2-B, 5, 6, 7, and 8, and for control of louver dampers located in branch ducts leading from plenum chamber in connection with supply unit No. 1; also vent dampers for corridor ventilators.

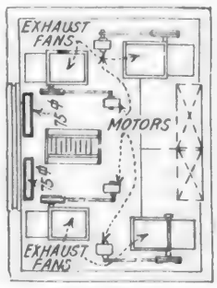
For the control of the domestic hot water supply there are, in connection with each water service heater, liquid insertion thermostats connected to control diaphragm valves located in the steam supply to the heaters. The thermostats are set to maintain the constant temperature of the water leaving the heater at 170° F. Two diaphragm valves are provided with each heater, Nos. 2 to 7 inclusive, one for service with low-pressure steam. Three-way cutoff cocks are installed in the lines to cut off air supply to valve when not in use. Heater No. 1 is provided with diaphragm valve for low pressure only.

For the control of the pool heater there are two liquid insertion thermostats. One is located in the supply line to the pool from the heater and is set at 90° F., and connected to operate the diaphragm valve in steam supply to heater. The second is located in the pool and is connected with the diaphragm valve located in the drip connection from the heater. This valve controls the amount of condensation leaving the heater. As the heating surface in the heater is proportioned for the filling of the pool, this method of control will provide for a more uniform control of the temperature of the water.

To prevent too high a water-line in heater, a water-line governor is installed with by-pass around diaphragm valve, to maintain condensation levels between predetermined points. A three-way valve is provided in air supply to thermostat in water-line to heater, so that this thermostat may be out when filling pool.

SWIMMING POOL EQUIPMENT.

In connection with the swimming pool, complete equipment is provided for heating, circulating, filtering



PLAN OF EXHAUST FAN ROOM.

and sterilizing the water, and for completely draining same.

For heating the water a horizontal steam service heater is provided with automatic control of the steam supply and return connections to same, as already described, for maintaining a constant predetermined temperature of the water in the pool, supplemented by a water-line governor for regulating the maximum condensation held in the heater when operating under light load. This heater will serve for bringing fresh water delivered to pool up to the required temperature and for the heating of the necessary "make-up" water, and to offset transmission losses when circulating water.

For circulating and draining the water in the pool there is provided a two-stage centrifugal pump, motor-driven, drawing water from near bottom of deep end of pool and delivering same near water-line at shallow end. This pump also serves for vacuum cleaning of pool, from outlets at sides of tanks, and during the time of operation in this capacity, suction connection of pump will be made to wet vacuum cleaner piping, instead of to pool, and discharge from pump will be to sewer.

For filtering the circulated water, two filters are provided, one on either side pump and heater, and cross-connected so that they may be operated as a unit or separately.

Sterilizing of water for pool is accomplished by passing same through two ultra-violet ray sterilizers, operating in series.

All of the piping in connection with the above equipment is so arranged that fresh water may be delivered direct to pool or through filters, heater, and sterilizer or any combination of same and when circulating, water may be delivered either through filters, heaters and sterliizers; filters and heater; heater and sterilizers; filter and sterilizers, with either one or two units of filter in use.

Cold water connects direct to pool and enters same near bottom of shallow end.

All equipment in connection with the above is located in equipment room No. 6.

VACUUM CLEANING SYSTEM.

The entire building is provided with improved equipment for vacuum cleaner service. Four independent systems of piping for cleaning have been provided, with connections from service valves leading to stationary machines located in various equipment rooms. Special vacuum cleaner service is also provided for the cleaning of the swimming pool.

The machines installed are of the wet vacuum type having discharge piping leading to sewer through catch basin located in floor near machine.

For the cleaning of the swimming pool there is provided a system of wet vacuum cleaner piping leading from service valves at the side of the pool to the suction connection of the circulating pump for pool, with discharge from pump provided with controlling valves and by-pass from same to bilge pump.

COMPRESSED AIR EQUIPMENT.

Two air compressors are installed for providing compressed air for temperature control system, and for hoists, tire filling, and cleaning in shops.

Compressors are motor-driven and are provided with automatic control so that they may be operated independently or simultaneously, according to the demand for air. Piping from compressors discharges to two high-pressure storage tanks suspended from ceiling from which two service lines are taken. One is for the temperature control system and the other for the shop service which extends to outlets in foundry, automobile and machine rooms.

Pipe and equipment covering was installed under a separate contract by the covering manufacturer.

Hot water storage tanks and combination heaters, recording meter, and humidity control heaters are covered with 1-in. magnesia blocks finished with ½-in. coat of magnesia cement, with the whole wrapped with 8-oz. canvas jacket cemented in place.

Instantaneous water heaters are covered with same material, except that magnesia blocks are 1½-in. thick.

Pool water filters are covered with 1-in. thick hair felt, with an interlining of waterproof paper, wired and wrapped with 8-oz. canvas cemented in place.

High-pressure piping is covered with 85% magnesia sectional covering; low-pressure piping with Keasbey and Mattisons "Bestovelt," cold water piping with ½-in. "anti sweat" wool felt, with interlining of waterproof paper; and hot water and circulation lines with ¾-in. wool felt interlining of asbestos paper.

All covered lines have neatly stenciled letters at various points to indicate the character of each line as follows:

High-pressure steam	H. P.
High-pressure return	H. P. R.
Exhaust steam	E.
Low-pressure steam	L. P.
Cold water	C. W.
Hot water	H. W.
Hot water circulation	H. W. C.

Equipment Schedule

EQUIPMENT	MANUFACTURER
Air washers	Carrier Air Conditioning Company
Fans	Buffalo Forge Company
Humidity control heaters	Whitlock Coil Pipe Company
Domestic water heaters	Whitlock Coil Pipe Company
Swimming pool heaters	Whitlock Coil Pipe Company
Vacuum pumps	Union Steam Pump Company
Recording meter	Yarnall-Waring Company
Recording gauges	Bristol Company
Thermometers	Taylor Instrument Company
Steam specialties	Kieley & Mueller Company
Roof ventilators	Kernchen Company
Automatic control system	Bishop & Babcock Company
Mushroom diffusers	Knowles Mushroom Ventilator Company
Vacuum system (low-pressure)	C. A. Dunham Company
Vacuum system (high-pressure)	Sarco Company, Inc.
Direct radiation	American Radiator Company
Vento indirect radiation	American Radiator Company
Pin indirect radiation	American Radiator Company
Wall radiator hangers	American Radiator Company
Standard radiator hangers	Healy-Ruff Company
Hand-control radiator valves	Dole Valve Company
Bilge pumps	Economy Pumping Machinery Company
Pool circulating pump	Buffalo Forge Company
Pool sterilizers	James B. Clow Company
Pool filters	James B. Clow Company
Vacuum cleaning equipment	Landers, Frary & Clark Company
Electric motors	General Electric Company
Switchboards	Frank Adam Electric Company
Motor generator set	General Electric Company
Wire and cable	American Steel & Wire Company
Clock system	Self Winding Clock Company
Telephone system	Couch Telephone Company
Program system	Self Winding Clock Company
Fire alarm system	Holtzer Cabot Company

CONTRACTORS

General construction	National Contracting Company
Heating and ventilating	American Heating Company
Plumbing	Stock Brothers
Automatic temperature control	Bishop & Babcock Company
Pipe covering	Keasbey & Mattison Company
Electric wiring	Sterling Electric Company

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Space Requirements for Mechanical Equipment

(*Continued from page 37*)

THE BASEMENT CEILINGS.

The basement ceiling is the place that attracts to itself the pipes and mains more often than any other place. And here it is that the trouble with deep girders and beams enters. The profile of the main piping is a straight line, slightly inclined to the horizontal. There may be exceptions to this. All sorts of schemes may be devised for making them other than straight lines and at the same time work satisfactorily. I often think that too many schemes have been devised.

The profile of the main being a straight line, the entire main must be below the bottom of the deepest girder, except as special provision is made. Consider, for example, a building, with most of the girders 26 in. deep, but with some of them 32 in. deep. The mains must be under the 32-in. level, except as provision is made otherwise. This, of course, brings the mains down to a level below the ceiling where the head-room is jeopardized. In such cases the pipes are very unsightly and seem to be hanging in midair.

In the case of drainage mains, it is difficult to make special provisions. City regulations do not permit traps in main drainage lines. They must be carried in straight lines in profile. Imagine, then, a soil pipe coming down in the center of a bay surrounded on all sides by deep girders, 32 in. deep, perhaps. The pipe is cornered, with no place to go. The only thing to be done is to bring down the pipe underneath the girders and carry it the entire distance through the basement at that low level, or offset it above into some other bay.

This one main, then, being low, the others may as well be placed alongside it. In fact, better, because there seems to be more excuse on the surface for having them low when a number are placed together than if only one were at this level.

Of course, the economical girder is one with a deep section. A girder of twice the width and half the depth will not carry the load but a girder of four times the width and half the depth will carry it, except perhaps for the extra weight of the beams. This involves extra expense, but in certain cases it is advisable to go to extra expense in the construction of the building if more than this amount can be saved in the construction and installation of the mechanical equipment and continual annoyance and unreliability be avoided in the operation of the building.

I would say, then that for a basement where there is a considerable number of pipes, something should be done to keep the girders shallow and of uniform depth. It does no good to keep most of them of uniform depth and then have deep ones scattered here and there. Sometimes in steel construction, holes are made through the girders, as an expedient. It will thus be seen that very much of the trouble is due to construction and much of it may be avoided by adding a little expense in the skeleton construction.

MAINS INTERMEDIATE FLOORS.

Intermediate in the height of the building the mains may have several locations on the ceilings, but usually when so placed they are furred in with a suspended ceiling. Here the same problem of depth of beams and girders enters because the mains must be in straight lines underneath the deepest girders and the furred ceiling must extend below these deep beams and girders to accommodate the mains. It is often considered that a certain amount of furring will be required for mains, perhaps 6, 8, or 10 in. That height is measured from the flat ceiling in the center of the panel, but if that idea is carried on through until the building is pretty well along, trouble follows because ultimately the ceiling heights will be found not sufficient. Sometimes the depth of furring required is more than was thought necessary. Sometimes the furred beams are carried down and around in cornices and false beams across the center of the panels.

PLACING MAINS IN FLOOR FILLS ON INTERMEDIATE FLOORS.

A floor fill is one way of disposing of the mains on intermediate floors. A floor fill suitable for carrying mains, must be approximately 5 in. in depth to give the required space for pitch. The thickness of the floor fill may be and often is anywhere up to 2 ft. in which case very often the ducts are also carried in this floor fill.

DOUBLE-FLOOR CONSTRUCTION ON INTERMEDIATE FLOORS.

A double-floor construction intermediate in the height of the building is very desirable, especially in hotel buildings where there is a certain number of special floors and above these, typical floors. I believe the time will come when every hotel building will be designed with a double-floor construction above the special floor and below the typical floors, because all of the pipes and risers coming down in the interior of the building must, at this level either be offset individually and carried down alongside columns, in partitions or special places with numerous crooks and turns, or connected to mains which are continued down at a few convenient places.

This space should be sufficient for access, at least 3 ft. in height. One of these floors is the main load-bearing floor and the other is an auxiliary floor of short spans, either suspended from the main floor or carried on struts.

Of course, the tendency is to place the auxiliary floor below the main floor with the idea that all the deep beams and girders and trusses may be carried in this space and leave a flat ceiling below, whereas if the main floor were below and the auxiliary floor above, those deep beams and girders would be exposed on the ceiling. This, however, is a mistake. As already pointed out in connection with basement mains, those beams and girders will not permit the passage of pipes, so that the thickness of the pipe space should be the required amount below these beams, except, perhaps, as it may be reduced slightly due to the fact that workmen making repairs may crawl under beams and find a working space in the panels. In general, however, it is best to place the main floor below and the auxiliary floor above, as the space between the girders will then be available to add to the height of ceilings in the rooms below.

(*To be continued*)

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ATTEMPTS to familiarize the public with modern heating and ventilating methods have made such comparatively slow progress and the advances in the art have been so rapid, that there is still a remarkable lag between what the industry has to offer for the comfort of the public and the public's appreciation of these comforts. Since the present coal shortage has brought home the need of more careful attention to the economical heating of buildings, many householders and others are now getting their first knowledge of such devices as temperature regulators and humidifiers, to say nothing of hygrometers and humidostats. Yet to tell the average householder that his daily humidity requirements are a matter of gallons of water, rather than quarts, comes as a total surprise.

That there is, however, an awakening going on is evidenced by the attitude now being taken by many doctors in recommending the use of humidifying devices in the home and in the increased number of inquiries regarding such devices. For instance, one house owner writes: "I hear a good deal these days about hygrometers and humidostats, but where can I buy them? Our local heating man (he wrote 'plumber') does not keep them and does not seem to know the first thing about them." If this situation is at all general, and we believe it is, it offers a fine opportunity to the industry to link up a sales campaign with one to familiarize the heating contractors and dealers, as well as the public, with the various types of air moistening devices, heat-regulating systems and other means for promoting health and economy.

"My wife," continues our correspondent, "has been reading up on the latest and most up-to-date methods of heating and ventilating the home, because we are paying $14.00 a ton for coal and find it scarce at that figure. We would buy some of these economy devices today if we knew just where to get them."

Before the winter is out we dare say the householders throughout the country will have gained more heating information than they ever had before. What is more, they are already in a most receptive frame of mind for suggestions as to methods of conserving their fuel and of providing ideal air conditions in their homes. The men in the industry are pretty well versed in the principles of both heating and ventilation and it now remains for them to show the public in a practical way how these principles may be applied and where the necessary equipment may be obtained. In other words, what is needed is a concerted effort to place on the shelves of the dealers the very appliances which are declared to be so useful in saving coal and in promoting health and then to furnish the dealers with full information as to their purpose and operation so that they will not be "stumped" by the layman when he starts taking humidity and the wet-bulb.

AS A rule, the discussion of either heating or ventilation, or both, written for public consumption, deals in generalities which seem trite to those in the profession. An exception to this is to be noted in the recent presentation in *Collier's Weekly* of an article by Harold Cary on "Save Coal and Keep Warm." In summarizing, as Mr. Cary does, the important developments of recent years in the advance of the art, taken from such authoritative sources as the Proceedings of the A. S. H. & V. E. and its Research Laboratory reports, and in presenting them in a medium of such general circulation, Mr. Cary's article constitutes the sort of propaganda of the utmost benefit to the industry, as well as to his readers. The presentation of the article is a striking example of the way the industry and profession may obtain the right kind of publicity when it is "put over" in the proper form.

COMPACTNESS in the construction of heating units has been for some time the order of the day, but has nowhere made greater progress than in the design of "boiler-feed sets," for use in connection with vacuum steam heating systems. As one manufacturer states, "the demand now is for a small centrifugal type of vacuum pump, suitable for handling both air and water and of such a type that it can be direct-connected to electric motors to avoid noise." The recent appearance of a number of types fulfilling these specifications is a healthy sign of progress that will undoubtedly result in the wider application of such equipment in places where its use has heretofore been out of the question from a cost standpoint.

SERVICE DEPARTMNT

The Design of Exhaust Systems

Data Covering Standard Practice in this Class of Work, Based on Experiments

BY H. W. PFEFFER.

Manager Boston Branch, American Blower Company.

PROBLEMS involving the conveying of material by air and the removal of vapors or fumes continually confront the engineer and metal contractor. To properly solve these problems and evolve a successful and efficient system should not be a matter of guess work. The many successful installations now operating prove that, with a general understanding of the fundamentals involved,—care in the design of the hoods, sizes of pipe, proper volume of air, determining the resistance of the system, and in the choice of the right type and proper size of fan—the element of chance is eliminated and the mystery attached to this class of work vanishes.

What is considered as standard practice in this class of work is the result of experiments proven correct and put into use. The data are here presented and are intended as a guide to cover this field in general.

AIR PRESSURES.

Air in motion in a duct system is under the influence of three distinct pressures,—first, velocity pressure; second, static or friction pressure; third, dynamic pressure or total head. It is necessary, therefore, that these three pressures be clearly defined.

Velocity Pressure is that pressure which creates the flow of air.

Static or Friction Pressure is that pressure required to overcome the resistance offered by the piping, etc., to the flow of air.

Dynamic Pressure or Total Head is the sum of the two, or that pressure which creates the flow of air and overcomes the resistance to the flow of air.

Pressures are usually expressed in terms of inches water gauge; for example, we will say an imaginary system requires a velocity pressure of 1-in. water gauge, and the resistance to the flow of air, or static pressure, is 2-in. water gauge; thus making the dynamic or total pressure at the fan 3-in. water gauge.

Expressing pressure in terms of ounces is still not uncommon but is fast becoming obsolete, as the measurements are always made in inches and transferred to ounces. One-inch water gauge equals 0.5768 oz. or 1 oz. equals 1.73-in. water gauge.

The pressure ratings of fans are made on a basis of either dynamic pressure or static pressure at the fan, some manufacturers using dynamic pressure as the basis of rating the fan air delivery, and others using the static pressure as a basis. This fact should be borne in mind when making comparisons of fans manufactured by different companies.

AIR VELOCITY IN HOODS AND CONNECTIONS.

One of the most important considerations in the design of a system for removing steam and fumes, or for handling material by air, is the design of the hoods or hoppers, as the case may be. The first consideration should be to close in as much as possible the cutter, wheel, vat, or other source of fumes or material, thus making it possible to handle them with a minimum volume of air.

It is obvious, of course, that the hood or enclosure must be so designed that it will not interfere with the efficiency of the workmen or process. By conferring with those in charge of the machines or processes involved, it is usually an easy matter to determine the proper design of hood, so as not to interfere with the work.

As an efficient system requires the handling of a minimum volume of air at the lowest possible velocity, care should also be exercised to catch either the fumes or materials to be conveyed in the same direction that the fumes or material naturally takes when leaving its source. It is then possible to pick it up with a current of air moving at a much lower velocity than would otherwise be possible.

From practice, minimum velocities have been determined for handling various materials, and while it is not possible to lay down any inflexible rules, the following table gives velocities and pressures usually ample for a given class of work. However, in some sections of the country, it will be found that local and State ordinances specify minimum velocity pressures required. Where this occurs, these ordinances should, of course, be the basis.

VELOCITIES AND PRESSURES REQUIRED IN EXHAUST SYSTEMS.

Approx Velocity 70° Air, Feet per Min.	Velocity Pres. at Hood, In. W. G.	Class of Work or material handled.
2750	½	Gases, fumes and very light materials.
3500	¾	Cotton, wool, and similar materials.
4000	1	Shoe machinery, sawdust, light polishing, buffing and grinding.
4500	1¼	Ordinary woodworking plant exhaust systems, heavy polishing, buffing and grinding.
5650	2	Wood working machinery taking heavy cuts at high speeds and handling green or wet lumber.

Sizes of connections for hoods over tanks, vats, kitchen ranges, etc., can most easily be determined as a pipe or pipes having an area proportionate with the total hood area. In most cases, the connections taken from the hood should equal one-twentieth of the total hood area. However, in cases where the volume of fumes given off is exceptional, the area of the

connections should be increased. It is rarely that this ratio need be carried below one-tenth.

Large hoods, to insure the best results, should have more than one pipe connection.

Example: Hood, 7 ft. long by 4 ft. wide.

7 × 4 = 28 sq. ft. area.

Small volume of fumes given off; therefore figure pipe to hood as having 1/20 area.

28 sq. ft. divided by 20 = 1.4 sq. ft. pipe area.

As the hood is 7 ft. long, use two connections:

1.4 sq. ft. divided by 2 = 0.7 sq. ft. area each pipe.

Nearest pipe 11in. dia. having 0.66 sq. ft. area;

Therefore, hood requires two 11 in. diameter connections.

SIZE OF HOOD CONNECTIONS FOR GRINDING, POLISHING AND BUFFING WHEELS FOR AVERAGE CONDITIONS.

Wheel Size	*Pipe Sizes, In. Diam.*	
	Grinding	*Buffing, Polishing or Rag Wheels.*
Up to 6 in. dia. Not over 1 in. face.	3	3½
7 in. to 12 in. dia. Not over 1½ in. face.	3½	4
10 in. to 16 in. dia. Not over 2 in. face.	4	4½
16 in. to 24 in. dia. Not over 3 in. face.	4½	5
16 in. to 24 in. dia. Not over 4 in. face.	5	5½

As we have given certain recommended velocities with pipes sizes, we have worked out, for ease in obtaining the volume of air required, the following table which gives the cubic feet of air per minute at 70° F. handled through hood connections. This is based on 0.8 coefficient of orifice which is found true in practice.

CUBIC FEET OF AIR PER MINUTE HANDLED THROUGH HOOD CONNECTIONS

Diameter of Hood Connection, In.	Velocity Pressure in Inches Water Gauge. ½	1	1½	2	2½	3	4	5
2½	75	109	136	153	171	187	216	241
3	107	157	196	221	247	270	312	348
3½	146	214	267	301	336	363	424	474
4	191	280	350	394	440	480	554	620
4½	252	360	460	519	579	632	730	816
5	299	437	546	616	686	750	867	970
6	430	629	786	887	989	1080	1248	1395
7	584	855	1069	1230	1345	1470	1692	1898
8	763	1118	1397	1572	1758	1920	2216	2480
9	965	1415	1768	1992	2225	2425	2800	3130
10	1192	1748	2182	2461	2750	3000	3462	3880
11	1440	2150	2640	2980	3320	3630	4190	4680
12	1730	2520	3142	3550	3960	4320	4990	5580

HOOD CONNECTIONS AND MAINS.

Hood connections should enter the main suction duct at an angle not exceeding 45°, and must incline in the direction of the air flow. Ends of the pipe must not project into the main pipe, and the pipe should be made so that all laps in piping point are in the direction of the air flow, especially where material is being handled.

All bends, turns or elbows in hood connections or mains should have a radius in the throat of at least 1.5 times the diameter and preferably twice the diameter.

All connections should have a shut-off gate and wherever possible, bringing two hood connections into the main exactly opposite each other should be avoided.

Wherever material is liable to accumulate in the main or branches, clean-out connections should be provided.

Hood connections and mains should be as short as possible and as free from bends as the work will permit, so as to keep the friction or static pressure as low as possible.

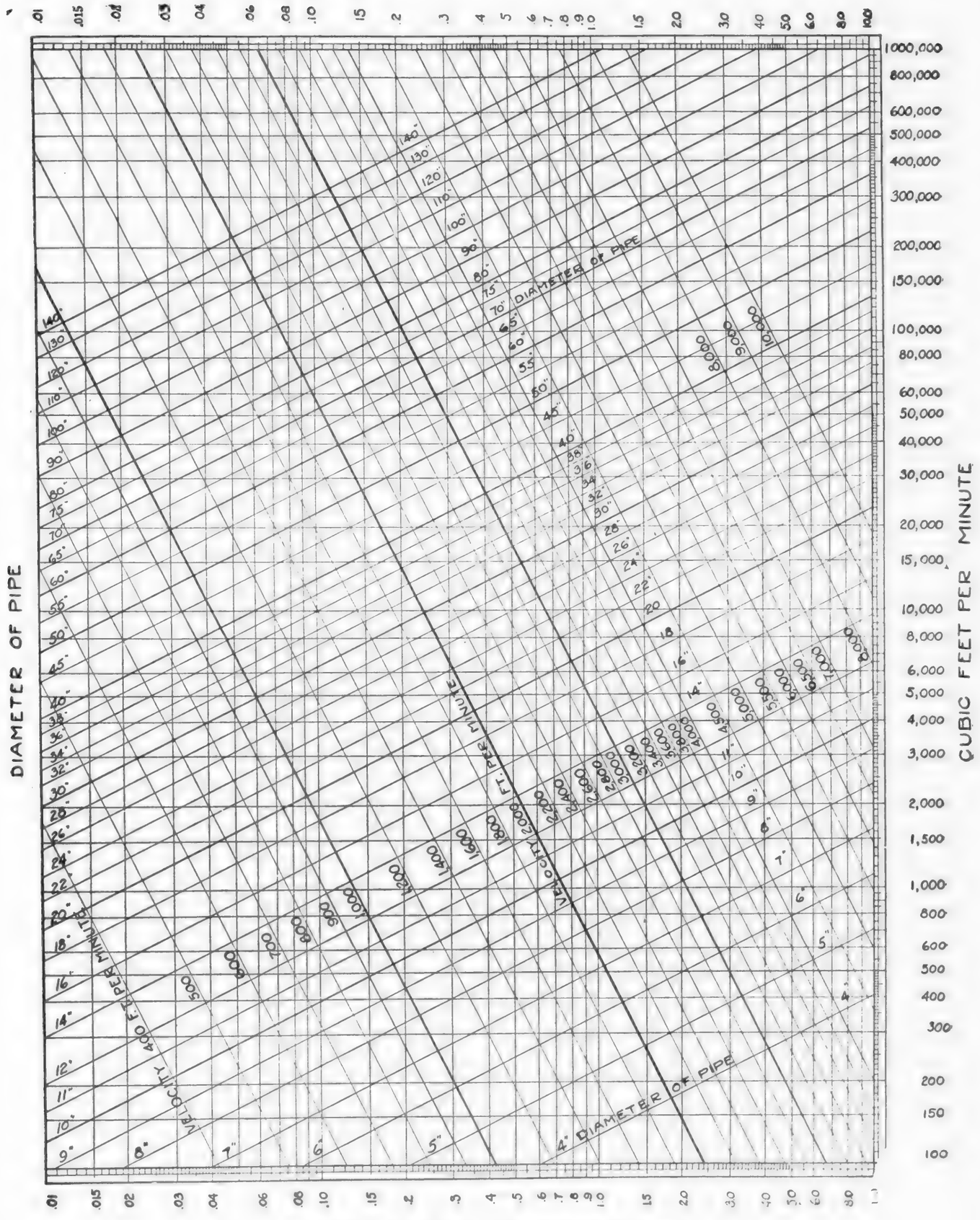
SIZE OF HOOD CONNECTIONS FOR WOOD WORKING MACHINERY.

Type of Machinery	Diameter of Pipe, In.
Matcher heads, each	5
Sash and cabinet shaper, each head	4
Door Tenoner	5
Sash Tenoner	4
Door and sash sticker, each head	4
Blind slat sticker	4
Blind Rail Router	4
Panel Raiser, each head	4
Sand Drum 24 in. long	4
Sand Drum 30 in. long	5
Sand Drum 36 in. long	6
Sand Drum 48 in. long	9
Sand Drum 60 in. long	11
Belt Sander up to 4 in. wide	4½
Belt Sander 4 in. to 8 in. wide	5
Belt Sander 8 in. to 12 in. wide	6
Disc Sander up to 24 in. dia.	5
Disc Sander 24 in. to 36 in. dia.	6
Rip saws and resaws up to 14 in. dia.	4
Rip saws and resaws 14 in. to 18 in. dia.	4½
Rip saws and resaws 18 in. to 24 in. dia.	5
Cut-Off saws not over 16 in. dia.	4
Band Saws up to 1½ in. wide	4
Band Saws 1½ in. to 3 in. wide	4½
Band Saws 3 in. to 4 in. wide	5
Band Saws 4 in. to 6 in. wide	6
Buzz Planers, moulders, planers, and all other machines having knives of dimensions given:	
Up to 6 in. long	4
6 in. to 8 in. long	4½
8 in. to 12 in. long	5
12 in. to 18 in. long	6
18 in. to 24 in. long	7
24 in. to 30 in. long	8
Floor Sweep Up	6

As we have given the recommended size of hood connections, from these the main pipe sizes can be determined by adding the area of each hood connection and increasing this sum by twenty per cent., to obtain the area of the main. In other words, the main pipe should always be twenty per cent. greater in area than the hood connections from which it exhausts.

FRICTION LOSS OF SYSTEM.

Having covered hood design with its connections and covered the velocities required from which we obtain the volume of air to be handled and proportioned the mains from the areas and volumes handled by the various branch hood connections, we have yet to determine the static pressure of friction loss of the system. Various thumb rules have been prepared. It has been found by experiment that elbows or bends with a radius of approximately one and one-half times their diameter have a friction loss equal to a straight pipe with a



FRICTION CHART NO. 1 FOR AIR FLOW IN PIPES.

length of six times its diameter; for example, a 24-in. elbow with a radius one and one-half times its diameter is equivalent to adding twelve feet of 24-in. pipe.

On straight piping it is found that a pipe forty diameters long causes a resistance to the flow, or a friction pressure, equal to the velocity pressure existing in the pipe; for example, if we have a 30-in. diameter pipe, with air traveling through it at a velocity pressure of 1 in. W. G., we will find that for every 100 ft., which is forty times the diameter, the resistance will equal 1 in.

The accompanying chart, entitled "Friction Chart No. 1," is plotted so that friction loss in inches of water for any diameter of pipe, with any velocity of air in feet per minute flowing through it, can be read. This is based on 100 ft. of pipe. For example, we will take the above-mentioned pipe of 30 in. diameter with 1 in. velocity pressure and 100 ft. in length. We know from the foregoing that 1 in. velocity pressure equals 4000 ft. per minute velocity. On referring to the chart, we find the line running upward at an angle on the diameter of the pipe side marked "30 inches." Follow this until we reach the line marked "Velocity, 4000 ft. per minute." Carrying this horizontally across, we find that 20,000 cu. ft. of air per minute is flowing through it. Or follow the vertical line downward, and we find that the friction in inches water gauge is 1 in. If the pipe is only 10 ft. long, the friction is only 1/10-in.

In estimating the friction or static pressure required, it should be borne in mind that the pipe on the discharge end of the fan should also be added to that on the suction side, as this is additional work which the fan has to perform.

TYPES OF FANS.

There are two general types of fans in use for handling air or air laden with fumes or materials, and the application largely determines the type which should be used. The type illustrated by Fig. 1 is generally known as the propeller type of fan. This fan is regularly manufactured with either pulley for belt drive from a motor, lineshaft, or other source, or with direct-connected electric motor. It is designed for handling relatively large volumes of air or air laden with fumes, at little or no pressure. As a general rule, this type of fan should not be used where the friction loss is more than ½-in. W. G.

The centrifugal type of fan is, in general, a fan wheel encased in a scroll-type housing. This type has practically an unlimited field of application. However, it must be borne in mind that for each classification of exhaust work to be accomplished, there is a specially designed wheel and proportioned housing to best accomplish the desired results, and the term "centrifugal type" should be used only as a general classification.

The Sirocco or multiblade type of centrifugal fan for instance, is especially adapted for handling air or air laden with fumes at pressures from ¼-in. W. G. to 5-in. W. G., but it should never be used for handling materials.

Where materials are to be handled, pressures ranging from 2 in. to 10 in, and higher are encountered. For this work the fan must be of rugged construction, should operate at a relatively low speed and should be of high efficiency. The so-called slow-speed exhauster is designed to meet these requirements. This type is shown in Fig. 4.

Where wool or similar material is handled, special-type wheels are designed by various manufacturers, arranged so as to prevent the material from catching in the wheels, along the lines illustrated in Fig. 5.

FIG. 1.—PROPELLER TYPE OF FAN, DESIGNED FOR HANDLING LARGE VOLUMES OF AIR OR AIR LADEN WITH FUMES, AT LITTLE OR NO PRESSURE.

COLLECTORS AND SEPARATORS.

There are many designs of collectors and separators now in the market, each having its so-called individual talking points, but the proportions are all more or less alike. It should be borne in mind, however, that, in choosing a collector, it should be the same size as the entering pipe; that is, an 18-in. discharge pipe from the fan should have a No. 18 collector.

FRICTION LOSS OF 90 DEGREE ELBOWS WITH VARIOUS RADII IN THE THROAT

Radius of Throat of Elbow in Diameters of Pipe	¼	½	¾	1¼	1	1½	1¾	2	2½	3	3½	4	4½	5	5½
Number of Diameters of Straight Pipe Offering Equivalent Resistance	67.0	30.0	16.0	10.0	7.5	6.0	5.0	4.3	4.5	4.8	5.0	5.2	5.5	5.8	6.0

For convenience in estimating the resistance of collectors, it will be found, in general, that the friction loss or static pressure required in the collector will rarely exceed the velocity in

$$0.2 \left(\frac{\text{Vel. ft. per min. in pipe}}{1000} \right)^2$$

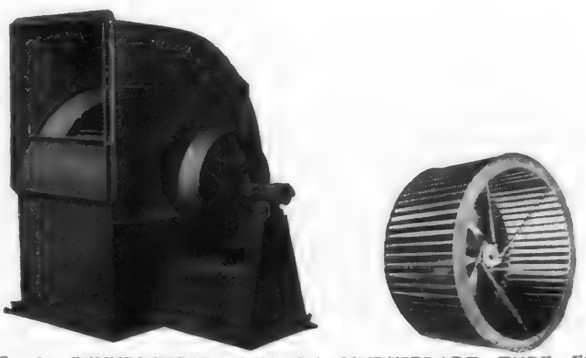


FIG. 2.—CENTRIFUGAL FAN OF MULTIBLADE TYPE FOR HANDLING AIR LADEN WITH FUMES, BUT NOT DESIGNED FOR HANDLING MATERIALS.

feet per minute in the pipe entering the collector, divided by 1000, squared, multiplied by 0.2:

The following are suggested gauges of material for round pipe. For ventilation work the piping need only be riveted, but

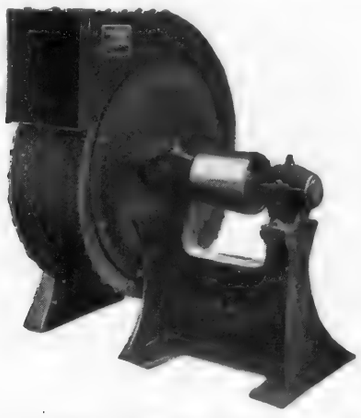


FIG. 3.—TYPICAL STEEL-PLATE EXHAUST FAN.

for exhaust work, the joints should be soldered and made air-tight; otherwise, considerable excess air will be handled:

GAUGES OF MATERIAL FOR ROUND PIPE, VENTILATION WORK.

Diameter, In.	Gauge.
Up to 15	No. 26
16 to 30	24
31 to 42	22
43 to 54	20
55 to 72	18
Over 72	16

GAUGES OF MATERIAL FOR ROUND PIPE, EXHAUST WORK.

Up to 5	26
6 to 8	24
9 to 15	22
16 to 24	20
25 to 32	18
Over 32	16

GENERAL SUGGESTIONS.

The following general suggestions should be borne in mind when considering this class of work:

When stringy material is handled, do not use a fan whose wheel has a shroud.

Emery wheel and buffing wheel systems should be kept separate because sparks from the emery wheel may set fire to the lint and dust from the buffing wheels if both are carried through the same suction main.

In large exhaust systems, it is often advisable to divide the machines to be cared for into convenient sections, taking care of each section separately with a fan and collector. The material from the several collectors can discharge into the inlet of a separate exhauster, which will carry the material over to the final collector, using less air and horse-power.

Where very long blows are encountered, it is good practice to

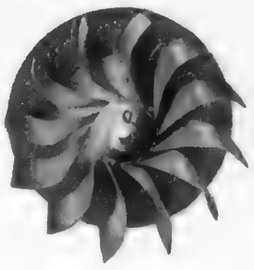


FIG. 4—SLOW SPEED WHEEL DESIGNED FOR HIGH MECHANICAL EFFICIENCY.

FIG. 5.—CAST-IRON WHEEL DESIGNED FOR HANDLING COTTON AND WOOL.

split the distance in two and put in a booster fan, connecting the discharge of the first fan into the inlet of the booster. This will save power and keep the fan speeds down where such conditions are encountered.

Where acid fumes are handled, the fan manufacturer should know the kind of acid, and an approximate idea of the volume of acid fumes given off, so that the proper dilution can be brought about, and the proper acid-resisting material incorporated in the fan.

Wherever air or gases exceed 200° F. in temperature, the fan bearings should be water-jacketed. The temperature of gases handled by fans should never exceed 750° F.

New Study Under Way to Determine in Velocities Steam Heating Mains

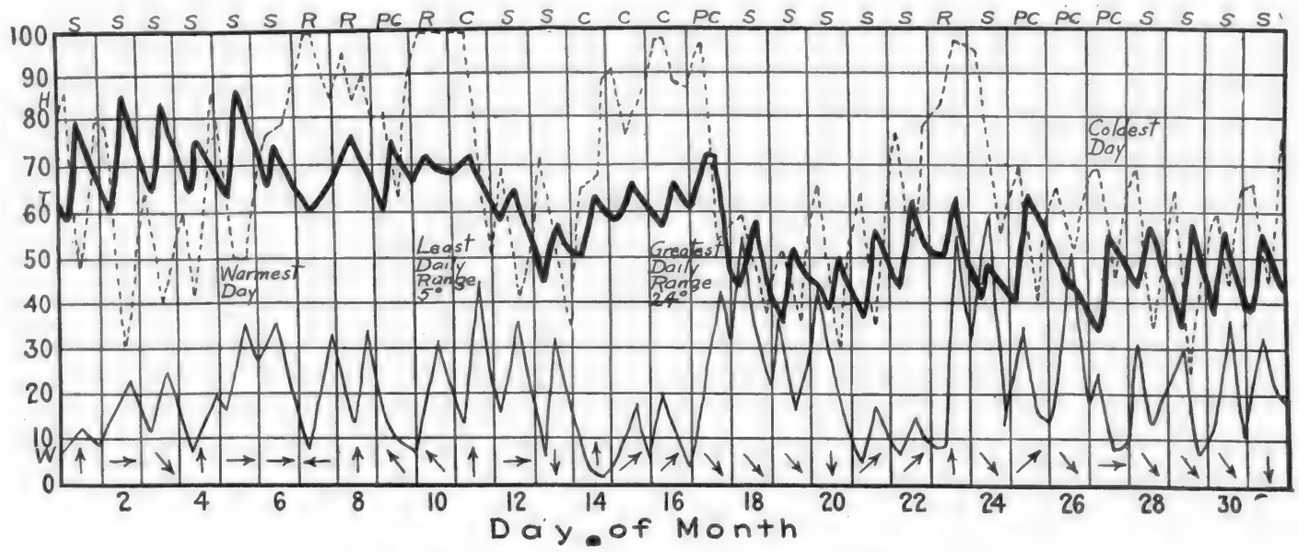
In addition to the research work already started on the capacities of steam heating mains as affected by critical velocities of steam and condensate mixtures, a new study of the unknown laws governing the size of steam pipes carrying steam at low pressure is being made at the Carnegie Institute of Technology in Pittsburgh. The work started during the past summer and will be continued next summer. It is being carried on in the Heating and Ventilating Department of Carnegie Institute by Professor L. S. O'Bannon of the University of Kentucky. Carnegie Institute, however, is financing the work on its own initiative, as a further step in its plan to tie up its educational facilities with outside industry.

The part of the investigation carried on last summer referred more particularly to the effect of the shape of the pipe entrance on critical velocity. It was also attempted, in an experimental way, to go deeper into the theory of flow of steam in one-pipe system heating mains in order to find an empirical law which may be used for purposes of general design. From this point of view Professor O'Bannon has shown tentatively, but not conclusively, that the maximum velocity in vertical pipes is equal to the acceleration due to gravity, modified more or less, depending upon the size of the pipe and the nature of the internal surfaces.

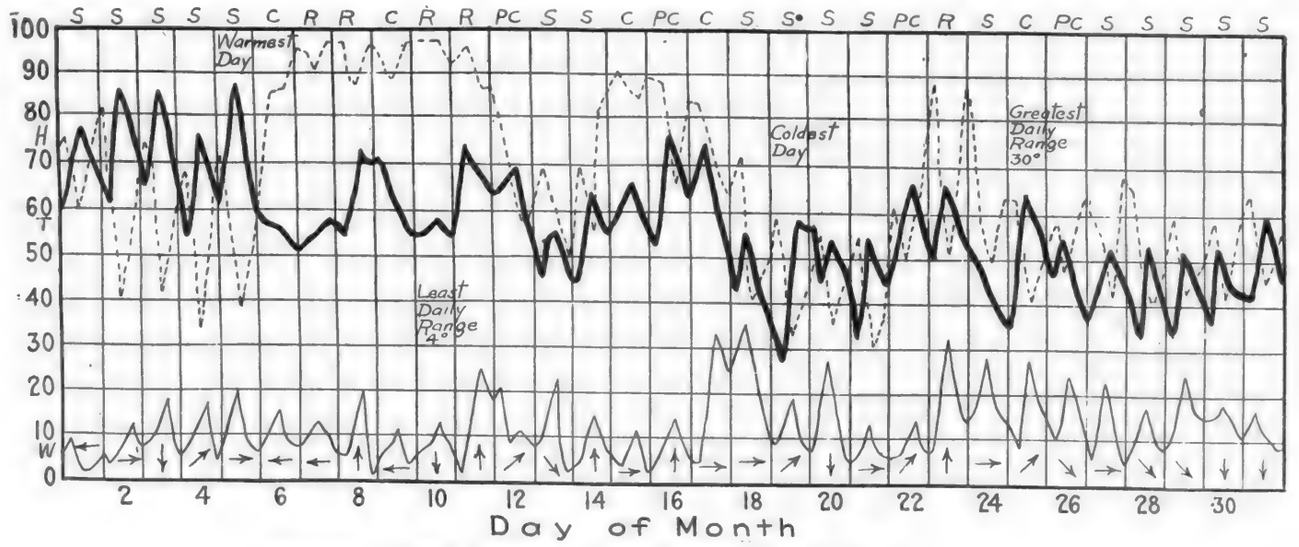
In the experiments to determine the effect of variously-shaped entrances, such as squared, rounded, reamed, and contracted entrances due to the use of cutters without reaming, the results seem to lead to the conclusion that the capacity of a pipe with a restricted entrance is no more than, and very nearly equal to, the capacity of a pipe of uniform cross-section throughout its length, with an area equal to the area of the construction in the larger pipe. There is only a slight advantage in rounding or reaming a pipe further than removing sufficient metal to leave the pipe free from any construction.

The Weather for October, 1922

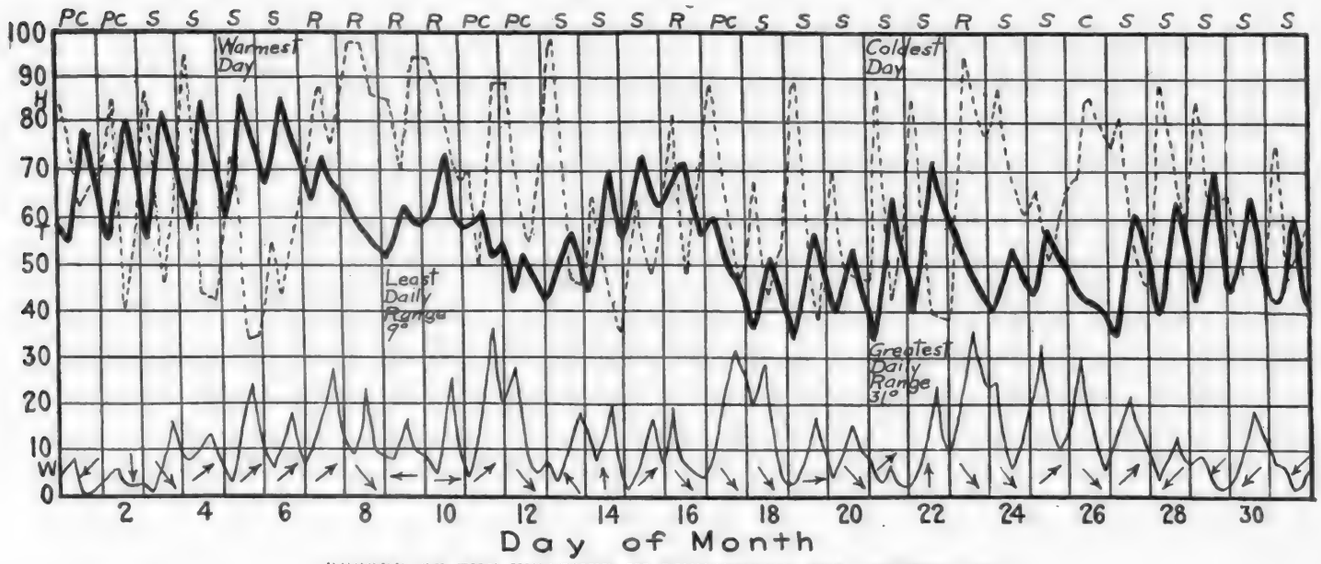
	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	87	87	86	87	90
Date of highest temperature	5	5	5	5	3
Lowest temperature, degrees F.	34	28	34	36	38
Date of lowest temperature	27	19	21	18	18
Greatest daily range	24	30	31	27	31
Date of greatest daily range	17	25	21	19	27
Least daily range, degrees F.	5	4	9	4	7
Date of least daily range	10	10	9	8	10
Mean temperature for month, degrees F.	57.6	55	56.4	57.6	62.2
Normal mean temp. for month, degrees F.	55.6	53	55.6	55.1	58.4
Total precipitation, in.	1.17	1.97	1.62	3.4	1.74
Total snowfall	0	0	0	0	0
Normal precipitation, in.	3.71	3.86	2.36	2.55	2.41
Total wind movement, miles	12,348	7,768	7,055	8,566	8,148
Prevailing direction	N. W.	W.	S. W.	N. W.	S.
Number of clear days	18	15	12	15	17
Number of cloudy days	5	6	8	9	5
Number of cloudy days	8	10	11	7	9
Number of days on which rain fell	8	5	8	8	7
Number of days on which snow fell	0	0	0	0	0



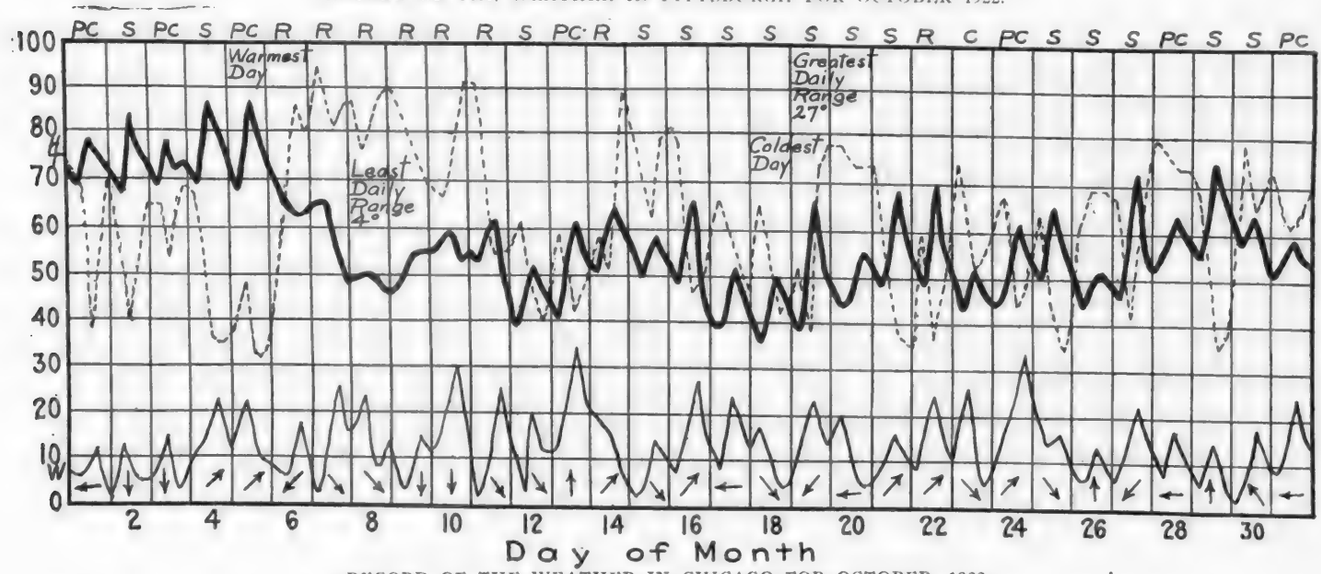
RECORD OF THE WEATHER IN NEW YORK FOR OCTOBER, 1922.
(Hourly Obervations of the Relative Humidity Plotted on this Chart.)



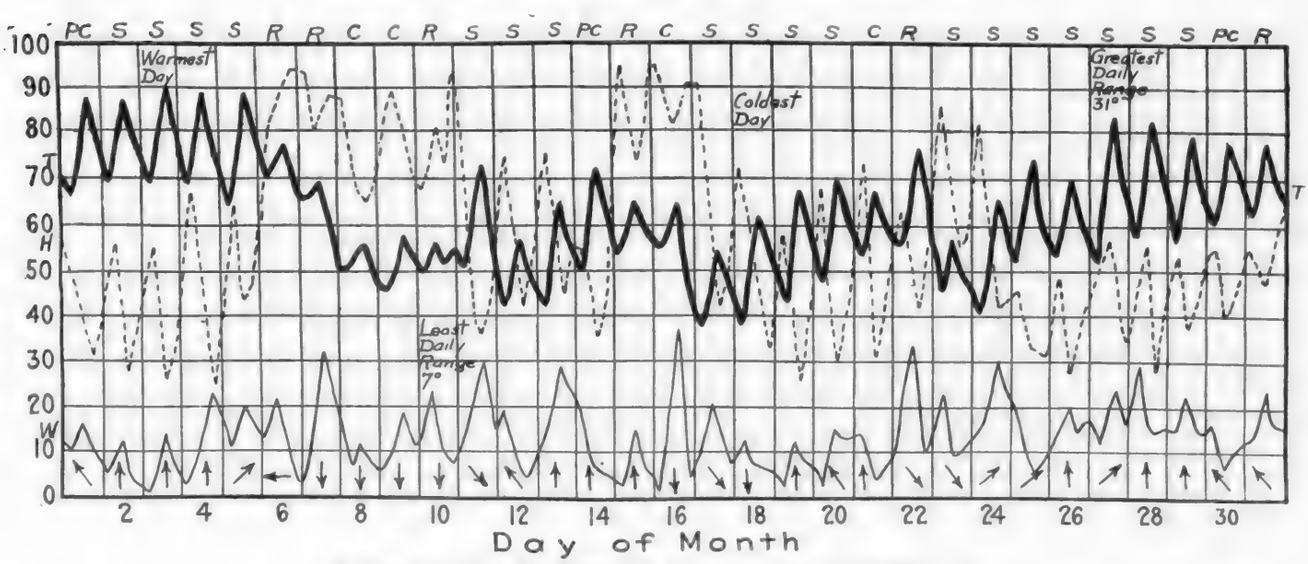
RECORD OF THE WEATHER IN BOSTON FOR OCTOBER, 1922.



RECORD OF THE WEATHER IN PITTSBURGH FOR OCTOBER 1922.



RECORD OF THE WEATHER IN CHICAGO FOR OCTOBER, 1922.



RECORD OF THE WEATHER IN ST. LOUIS FOR OCTOBER, 1922.

Plotted from records especially compiled for THE HEATING AND VENTILATING MAGAZINE, by the United States Weather Bureau.
Heavy lines indicate temperature in degrees F.
Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings taken at 8 A. M., 12 M., and 8 P. M.
S—Clear, P C—partly cloudy, C—cloudy, R—rain, Sn—snow.
Arrows fly with prevailing directions of wind.

Establishing a Balance in Maintaining Comfortable Air Conditions

Prevention of Heat Losses of Every Kind as Important as Providing Sufficient Heating Capacity

THE wag who declared, in a discussion of heating methods, that what we need are more clothes on the backs of the ladies rather than higher indoor temperatures, was more than half right, even if he spoke from a general premise. Some definite figures are now available on the heat-retaining value of cloths and were published recently in the *Journal* of the Leeds University Textile Association. The method of testing, as described by Howard Priestman in that publication, consisted of the use of three copper cylinders each 10 in. high and 10 in. in circumference, standing on a base and having lids through which heat could not escape. This left 100 sq. in. from which radiation could take place. Each cylinder holds 1 liter of water which was raised to the boiling point over a Bunsen burner, and each had a thermometer introduced through the lid so that any fall in temperature could be accurately read.

That there are two entirely different functions involved was made amply clear at the outset when it was discovered that less heat escaped from a naked copper cylinder than from one which was covered with a jacket of 14 oz. cloth. This emphasized the need for greater care in using this method even if only comparative results were in question.

It is probable that the relations of conduction to radiation also account for the fact that one thickness of a cloth prevents the escape of a great deal more heat than half that which will penetrate two thicknesses of the same fabric. That is to say, a jacket of single serge will retain heat equal to 26 units, but a double jacket of the same will only retain 44 units. It is easy to see that these figures are the exact reverse of what one would expect, or else that the method of reckoning the heat retained should be transmuted into heat escaping, or heat conducted first through the cloth and secondly into the air.

The amount lost by conduction would therefore be nil, and this fact throws into strong relief the fact that a rough surface radiates very much more heat than a smooth one. For the average radiation from the copper was only 61.10 in an hour, while that from the same cylinders covered with thin cashmere was 69.83. If, therefore, poor conducting power of the cashmere prevented 5 units from reaching the surface of the cloth from the surface of the cylinder, the power of the surface of the cloth to radiate is evidently greater by $69.83 - 61.11 = 5$, that is to say, by 13.72.

The reader must not regard these figures as correct. They are only taken at random, and even the deduction must only be regarded as an illustration of the double nature of the problem. It may be stated in the simplest words; that there is less heat at the surface of the cloth than there is at the surface of the copper, and yet so much more heat can radiate from the fibrous face of the cloth than can radiate from the polished surface of the copper, that the total loss is greater when the copper is covered with a jacket of thin cloth.

Further, this apparent anomaly made it necessary to cover every one of the cylinders with a thin under-jacket of cashmere over which the cloths to be tested were wrapped, and in all the following description a bare cylinder must be taken to mean one which was covered only with cashmere in this way.

EXPERIMENTS MADE IN TRIPLICATE.

In order to avoid any error due to possible difference between any of the cylinders, every experiment was conducted in triplicate.

To begin with, each cylinder was placed above a Bunsen burner, and a litre of water which it contained was raised to boiling-point, which in most conditions of the barometer was 211°. At the end of 1½ hours the thermometer in the bare cylinder registered 87°, the one covered with serged registered 108°, and the one covered with tartan 113°. This meant that the bare cylinder had lost 124°, the serge cylinder 103°, and the tartan 98°. In other words, the serge had kept in 21° which would otherwise have escaped, and the tartan had kept in 26°. The tartan was thus 5°, or 24% better than serge in its heat-retaining properties. After each change of cloth the figures were taken out in the same way and the average was made from the three tests on the three different cylinders.

MEASURE OF EFFECT OF WIND.

To obtain the value of the cloth for retaining heat in wind, an electric blower was put in a tunnel so that the air current impinged equally on the three bottles, but in this case each bottle was moved once every half-hour, so that any possible variation should again be averaged. When such precautions as these are taken, it seems impossible that the relative values of the tests can be very far from accurate, and it is interesting to notice that they indicated with no single exception that the opinion of the army clothing department was absolutely correct in the value it placed upon each of the different types of cloth which were served to the army in pre-war days.

Similar difficulties arise if we cover a layer of serge with very thin paper and weighing one-tenth of the weight of the cloth, and find that thereby the figure 26 is increased to 37. The single sheet of paper alone (weighing less than 2 oz. per 54-in. yard) conducts and radiates units equal to 167, or only 5° more than a jacket of 21-oz. serge. That is to say, it retains 31 units.

In this last case it is easy to tell by the feel of the paper that conduction is extremely good. The surface of the paper is too hot to be held in the hand, but nevertheless the amount with which it parts by radiation is only slightly more than the total loss by the serge.

There is yet one more comparison in which paper and serge take part that may yet throw light on the problem, that is to try paper next to the cylinder and serge outside. We ought then to get the conduction of the paper apart from its radiating properties, in which case the total result could be compared with the total result when the serge was within and the paper was the only radiating surface.

To complete the series, comparisons were made between two jackets of serge and two jackets covered with paper, also three jackets, plus paper.

TABLE 1.—RESULTS OF EXPERIMENTS TO DETERMINE HEATING RETAINING PROPERTIES OF CLOTHS

	Units escaping from 3 cylinders in one hour.	Heat retained.	Retention Due to Poor Conductivity of		Retention Due to Less Radiation and Convection from Surface.			
			Serge.	Paper.	Serge.	Paper.	Total.	Discrepancy.
Jacketed copper	197	..	..	..	..	..	..	..
Serge	171	26	18	..	8	..	26	..
Serge and paper	160	37	18	5	..	13	36	1
Paper and serge	166	31	18	5	8	..	31	..
Paper	179	18	..	5	..	13	18	..
2. Serges	154.6	44.3	18	..	7	..	43	1.3
2. Serges and paper	146½	52½	18	5	..	11	52	0.5
3. Serges	137	60	18	..	6	..	60	..
3. Serges and paper	136½	68½	18	5	..	9	64	0.5

RADIATION AND CONDUCTION.

When the tests from the various cloths are compared with the amount radiating from the naked cylinder, a series of figures is obtained which ought to disclose some facts of value regarding the relation of radiation and conduction. The probability is that the whole problem is very complex. In the first place, it is extremely likely that the relation of conduction to radiation is different at different temperatures. If this is so, it raises two strong arguments against the system of noting the fall of temperature in three similar cylinders from 212° downwards. It is clear that in any case, the nearer the temperature of the water is to the surrounding air, the less will be the loss in a given space of time, and for this reason readings for the first, second, and third half-hours are bound to vary.

For this reason the figures used are those which represent the fall in temperature in the first hour.

From such a series of figures it should be possible to separate the conductive properties of the cloth, from the radiation which takes place from the surface, both by convection and by radiation proper. It should be an easy problem, if the figures represent a large enough number of tests to give an accurate average. Results may also be arrived at by very simple arithmetic combined with a little thinking.

For instance, to divide the value of paper into what it saves in conduction, and what heat it prevents the escape of by its non-radiating properties, may surely be arrived at as follows:

Serge only prevents the escape of 26 units. Serge over paper prevents the escape of 31 units. And as the radiating surface is the same in both cases, the radiation value of the paper being destroyed by its contact with the serge, then only conduction of the paper remains. It is therefore 5 units. Paper only prevents the escape of 18 units. Five being attributable to conduction, the remainder due to little reduction in radiation must be 13 units.

ANALYSIS OF FIGURES.

These figures place us in a position to analyze the above results for the prevention of the escape of heat as shown in Table 1.

This table is a summary of figures arrived at up to March 31, 1919, column 1 showing the number of units lost in three tests, the figure for heat retained being arrived at by deducting these figures from the index figure for loss shown by a cylinder in cashmere jacket only.

One fact is once again obvious: two thicknesses of cloth do not retain twice the heat retained by one thickness.

Three thicknesses retain relatively still less.

This apparent anomaly is in all probability caused by the same factors that cause the great discrepancies in the heat-retaining values of cloths of different weights.

Retentive value seems to be principally due to poor conductivity through the body of the cloths, as well as to retention due to the less amount of radiation from the surface of the cloth than there is from the surface of the cylinder when covered with cashmere.

Discrepancies are probably due to errors in the index figure used. An average figure is no use, as it constantly varies. Hitherto it has been necessary to get direct tests at the same time for any two cloths or combination of cloths that it is desired to compare.

The alteration of the index makes Euclid's axiom of no use. In these tests things that are equal to the same thing are not necessarily equal to one another.

To state the fact more accurately, it would be necessary to say that things that have a certain proportion to the same thing have not necessarily an equivalent proportion to one another.

Secondly, it is contended with much show of reason that the temperature of the human body is not 212°, and that any comparison ranging downwards from that figure may possibly be fallacious. To test this an apparatus was designed and described in American papers of last year. In it a metal cylinder is maintained at any uniform temperature by the radiation of heat by electric wires, and the amount of electricity required to maintain the heat of the cylinder exactly at any given degree is measured accurately and recorded.

Instead of the escape of heat being registered by a drop in the thermometer, a similar escape of heat is recorded in the number of electric units which are required to make good the loss.

DIFFICULTIES OF METHODS.

It seems that the same problems will arise in the comparison of figures from this apparatus that are met with in thermometer readings. Some figure must be obtained with which all others can be compared. In the case of the electrostatic apparatus this figure would be the number of electric units required to keep the naked cylinder at any given temperature. The value of the cloths would be the difference between these figures and those obtained when the cylinder was covered with a jacket of the cloth to be tested. In this respect there would be an analogy between the loss of heat from the water in my cylinders and the electric units of the American method.

Both will require the same careful handicraft in the application of the cloth to the machine, and is probable that three machines which can be worked together will be needed in both cases.

II—Weatherproofing of Houses.

The most important factor in establishing a balance in connection with the heating of buildings is the preventing of any unnecessary loss of heat. According to a recent statement of the Division of Building and Housing of the Department of Commerce, saving of fuel has not been considered in the building of most houses. Many have been shabbily built and permit too much cold air to enter the house. While it is true that most attention should be given to the proper building of new houses, much can be done, states the department, to prevent the loss of heat in poorly-built and run-down houses.

All houses, it is pointed out, should be well ventilated, but this does not mean that unregulated drafts of cold air should sweep through the house at all times. It should also be remembered that in cold weather the warm air is continually escaping. Cracks around the windows, broken window panes and unprotected heating pipes indicate that fuel is being wasted. Millions of tons of coal, it is estimated, can be saved this winter by the making of slight repairs on houses and the exercising of a little more care in burning coal.

In making an inspection the points to examine are the windows, doors, transoms and floors. The attic and basement should also be inspected, as well as the damper in the fireplace and cracks under the baseboard. An astonishing amount of cold air comes in around the windows or through them. Windows are often poorly fitted into the openings. Occasionally it is possible to see between the brick wall and the window casing. Window sashes are rarely fitted snugly and cold air enters freely around the sash. It is not uncommon to find a wide crack between the upper and lower sash. Such cracks can sometimes be closed by means of a sash lock. The use of weather-stripping will take care of most of the cracks around a window and the saving of coal will be well worth while in a large number of houses. It is also well to go over all windows to see that putty is in place around the panes.

Double or storm windows are recommended, especially in cold climates. Storm windows might be put on the side of the house facing the prevailing wind, where they could not be afforded for all windows.

Doors, especially those leading outside, are often poorly fitted and air passes freely both above and below them. The crack below the door is often so large that cold air sweeps across the floor, keeping the interior cold. A strip of cloth or felt nailed to the floor or to the door will keep out much of the cold. Storm doors, of course, are very effective in preventing the inrush of cold air.

FLOORS AND BASEBOARDS.

While double floors are becoming more common there are many houses in which a single floor is nailed direct to the joists. If tongue and groove flooring is used, there is no draft, but there are floors with cracks between the boards. If there is no basement under this part of the house, cold air will enter.

In houses where there is no firestopping between the studs of the wall, cold air can pass freely from the attic to the basement. In such houses, if the plaster goes down only a little below the top of the baseboard, much air enters the rooms under the baseboaards if they do not fit closely. Such cracks should be closed.

BASEMENTS.

In some houses the warm air can pass from the basement upward between the studs. If such is the case it is advisable to close the openings between the joists

with old brick, or some other material. Basement doors and windows should be examined and made as tight as those in the rest of the house. Cold air entering the basement cools the heating pipes and furnace and the floor above.

ATTICS.

Attics are usually cold and give plenty of chance for cold air to enter the house and for warm air to escape. Sometimes shingles are nailed direct to cleats and the out-door air enters between the cleats at the ends. Again free passage-ways for air in the walls, between the attic and the basement, keep this cold air in circulation. If the openings between the cleat ends are closed cold air may be kept out. The windows in the attic should receive as much attention as those in other parts of the house. Dead air in an attic keeps the lower stories warmer, while the direct opposite is the case with currents of air. The currents must be avoided and this is accomplished if the house is properly firestopped.

Novel Use of Dolls in Demonstrating Air Conditions.

As someone has said, if we could only color the air in occupied quarters and have one color represent pure air and another color contaminated air, the public would soon become educated to the necessity of proper ventilation. A step in this direction has been taken in Chicago in the construction of a show window display, consisting of two model theatre interiors, in one of which good air conditions prevail and in the other bad air conditions.

To demonstrate the contrast, use has been made of "breathing dolls" made of paper and intended to represent a typical theatre audience. In one of the theatres the occupants are shown to be suffering from the effects of bad air. The actors on the stage are manifestly weary, lacking in "pep" and "dragging." The audience appears bored, while the ushers seem listless and languid.

In the well-ventilated theatre, miniature fans are in operation, and a hidden electric fan of normal size floods the auditorium intermittently with air. Here every one appears wide-awake, alert and on the *qui vive*.

Words are hardly needed to drive home the thought intended. To make the demonstration doubly clear, however, a placard above the display reads:

> THE BREATHING DOLLS
> Demonstrating Proper and Improper Conditions in Theatres.
> Ventilating—Heating—Lighting.
> Note contrast in air conditions, activity, interest.

DEMONSTRATION OF GOOD AIR CONDITIONS BY USE OF "BREATHING" DOLLS.

Report of A. E. S. C. on Approval of Ventilation Code.

The full text of the minute of the American Engineering Standards Committee, which had under consideration the approval by the A. E. S. C. of the Ventilation Code of the American Society of Heating and Ventilating Engineers, is as follows:

"The report of the special committee on the Safety Code on Ventilation, submitted by the American Society of Heating and Ventilating Engineers for approval, was presented by Mr. Williams. The Society was planning to revise the code during the coming year in order to include important developments in the subject, and particularly the results of work of ventilation now in progress by the society. It was to be expected that the revised code would be acceptable to all interested bodies. In accordance with the recommendation of the special committee, and upon motion by Mr. Williams, it was unanimously

RESOLVED, that, inasmuch as the sponsor, the American Society of Heating and Ventilating Engineers, is planning to bring out a revised edition of the Ventilating Code in the immediate future, the code be referred back to the society, in order that the revision at the hands of a thoroughly representative sectional committee shall assure its acceptability to all interested bodies."

In a memorandum accompanying the minute it was stated that "the committee finds that this code, which has not been revised since 1915, contains at least one provision which is admitted to be in conflict with present good practice, while other provisions are questioned. The A. S. H. & V. E. is conducting extensive experiments for the purpose of securing engineering and medical data on which scientifically accurate ventilation requirements can be based, and expects to have at least a partial report within a year, and as soon as these experimental data are available, the society intends to revise the present code.

Among the principal points brought up in connection with a revision was the recirculation of air and the use of ozone. The present code throughout stipulates the use of "outdoor" air, while most of the state and municipal requirements specify "fresh" air, "pure" air or "air from an uncontaminated source."

Autumn Meeting of British Heating Engineers.

John Watson, director of the Atmospheric Steam Heating Co., Ltd., of London, was elected president of the Institution of Heating and Ventilating Engineers at the autumn meeting of the institution in London, October 10. Among the committee reports was one on the subject of utilizing waste heat in large plants. Frank Biggin, for this committee, reported that the work was being carried on in conjunction with the Institution of Electrical Engineers. It was hoped, he said, later to receive the collaboration of the Institution of Civil Engineers and other technical societies.

The principal paper presented at the meeting was on "Some Points in the Law of Heating Engineers' Contracts," by Robert Fortune.

How to Keep the Inside of a Tent Cool.

Some time ago the Bureau of Standards was requested by a branch of the Air Service to devise a means for keeping the interior of balloon hangars at as low a temperature as possible. This was done successfully and the results are equally applicable to tents.

If the outside of the tent is covered with a highly reflecting substance, such as white paint, while the inside is covered with aluminum paint, the radiation into the interior of the tent may be reduced by at least 78% to 81%. The reason why this method of painting has this desirable effect is that the white paint reflects the sun's rays while the aluminum paint is a poor radiator of the long wave-length heat rays. Of course, it must be remembered that this scheme for painting tents would have just the reverse effect at night and would prevent the heat on the inside of the tent from escaping into the cooler air outside.

This same work proves that aluminum paint is the poorest possible kind of a coating for heat radiators in houses, at least from the point of view of obtaining the greatest amount of heat.

Cracked Sections in Cast-Iron Steam Heating Boilers

Low water is probably the most common cause of cracks in cast-iron steam heating boilers, according to a writer in the Travelers' Standard, a periodical issued by the Engineering and Inspection Department of the Travelers Insurance Company of Hartford. Lack of attention is mentioned as the most important contributing cause.

Heating boilers, as the article states, are often attended by persons, both men and women, who know little or nothing about the proper care and operation of them. Frequently one man takes care of the boilers in several buildings. He may be thoroughly competent to do the work, but in severe weather when the boilers need the most attention it is often impossible for him to look after every one with sufficient frequency to give it proper and adequate care.

Cast-iron boilers are usually provided with all the appurtenances necesary to make them safe, but it does not follow that the attendant knows what the safety appliances are for, or if they are in working order. Many times persons operating boilers do not know what the water glass is for, or where to put water in the boilers.

Boiler inspectors find it necessary to examine the connections on heating boilers very carefully. The piping and fittings may be properly arranged, and the faulty installations may be the direct causes of cracked sections; or the water-glass connections may be clogged so that a false water level will be shown; or the water glass may not be installed at the proper elevation on the boiler; or feed-pipes may be situated where the water in them may freeze, and of course, no water can get to the boilers through a frozen pipe.

With the gravity-return system the steam passes from the boiler into the pipes and radiators, where it condenses; and the water of condensation then returns to the boiler by gravity. Stoppages in the return pipes, on acount of freezing or from any other cause, prevent the water from returning to the boiler and low water results; or the return valves may be closed, so that the radiators fill with water while the boiler goes dry.

Even when a pump is provided to return the condensate to the boiler, the pump may get out of order and stop, or the attendant may stop it intentionally and neglect to start it again, and thus the water in the boiler gets low.

Fusible plugs are sometimes placed in cast-iron sectional boilers, and when the water becomes low these plugs are supposed to give warning by melting and allowing steam and water to escape from the boilers. A fusible plug is not always to be relied on, however,—chiefly on account of deterioration of the fusible metal, or because the end of the plug inside the boiler becomes heavily covered with scale or rust, which prevents the steam from escaping and giving warning, even when the plug melts. On the other hand, an inspector, when examining a boiler, may find the fusible plug melted out, and a crack, also, in a section some distance below the plug,—showing that a fire had been kept burning when there was little if any water in the boiler. Occasionally a boiler is entirely ruined because the attendant maintains a hot fire in the furnace after the fusible plug has burned out and a section has cracked.

There are other causes for cracked sections, in addition to low water; and one of them is the common practice of burning waste paper and other refuse matter in the furnace during the summer, or in the fall before the heater is started. A quick, hot fire is often made with this material, and even if there is water in the boiler (and sometimes the boiler is empty) cracks are likely to result because the metal directly exposed to the fire is heated very quickly and expands more rapidly and to a greater extent than the parts of the boiler that are farther away from the fire. The cracks are caused by the unequal expansion of the different parts of the boiler, brought about in this way.

Cracked sections may result from internal strains in the castings. The sections are cast in sand, and (as with all other iron castings) internal strains are likely to develop in them when they cool. Cracks due to this cause may not develop until the boiler is put in operation, when the alternate bearing and cooling, accompanied by expansion and contraction, cause the overstrained material to fail.

When a new boiler is set up and inspected, a hydrostatic test is supposed to be applied, to ascertain if there are any leaks. A boiler may pass the test satisfactorily and yet a leak may develop afterward, when the boiler is put in operation. On examination the inspector may find the casting defective, and that the leak is at a point where there is only a thin skin of metal over some core sand.

The attendant, when poking the fire, may use the poker or slice-bar too energetically and strike a section with sufficient force to cause a crack. A defect in the valves, where two or more boilers are set in battery, may cause one boiler to drain into another, and thus produce low water and cracked sections. Inadequately or improperly constructed foundations may cause a boiler to settle unevenly and in such a case cracks may result.

It is impossible to permanently repair a cracked section. Autogenous welding has been tried, but as a rule it has not been successful. Small cracks may sometimes be closed temporarily by using a special cement, and by this means it may be possible to postpone permanent repairs until the end of the heating season, or until the weather becomes milder. Replacement of the cracked section is the only proper remedy, however, and replacement must eventually be made, although it is often difficult and expensive.

On account of the nature of the material used, it is impossible to prevent entirely the cracking of the sections of cast-iron boilers. A great deal of the trouble can be eliminated, however, by having a competent inspector examine a new installation before the boilers are put in operation, and by having him make periodical inspections thereafter. A good inspector will detect mistakes in the arrangement of pipes and fittings, and other conditions that may cause sections to crack. He will also be able to advise the attendant with regard to proper operating methods. Persons familiar with modern steam-heating practice believe that it is equally important to have regular inspections on both cast-iron sectional and steel heating boilers.

Savings with Fuel-Oil in Singer Building.

When fuel-oil jumped into prominence a few years ago in the East as a substitute for coal in large office building plants, the installation perhaps most often referred to was that in the Singer Building, New York, of which Norman King is chief engineer. The good results reported in this building were widely quoted so that some authoritative statistics on the subject are doubly welcome. These are now available through an article contributed by Mr. King to the New York Building Superintendent, published by the New York Building Superintendents' Association.

The sum and substance of Mr. King's report is that two years' operation with fuel-oil shows a 34% saving over coal. On that basis the installation paid for itself in 21 months.

As Mr. King points out, for the engineer who contemplates changing from coal to fuel-oil, the first step is to ascertain if it is really possible to do so under the rules and regulations that govern storage of oil and equipment to burn it. He must know what it actually costs to generate steam with coal, including stand-by losses, labor, ash removal, etc., what he is paying for coal and what he would have to pay for oil. After this is determined and if a profitable saving is indicated, he must consider the reliability of supply.

Every engineer must figure on the basis of his own conditions and the particular job. When this has been decided, he should apply to the municipal authorities for a set of rules pertaining to indoor storage of fuel-oil. Each rule must be well studied. If he feels assured that these rules can be met, he will be obliged to make plans that will cover every rule 100% to submit to the building and fire departments for approval. It is important that all apparatus indicated on the plans be of approved type, as this will save an enormous amount of time and discouragement. Try in every case to bury the storage tanks, as this permits 100% greater storage capacity.

Height of boiler settings is important and is one of the weak points in the usual hand-fired boiler room in New York City. If the maximum rating is known at which it is desired to operate the boiler, it does not pay to install a greater furnace volume that will burn the required amount of oil to produce the same rating provided the heating surfaces are in a condition to receive the heat produced in the furnace. Too great a furnace volume means a cold

furnace and therefore poor combustion.

The type of burner is a question, steam or mechanical, requiring early decision. Where first cost counts, the steam atomizer invariably is chosen because of the lower pressures involved and stack conditions. The mechanical atomizer is best adapted where high ratings are to be considered and the human element practically cut out.

Refractory furnace lining is another important item in order to keep down furnace repairs. First cost should not be considered where reliability and continuous operation are imperative. "Safety-first" is the slogan throughout.

Correspondence

The White Portable Air Conditioning Machine.

EDITOR HEATING AND VENTILATING MAGAZINE:

Can you give me any information as to where I can obtain a White portable air-conditioning machine, as described in your issue for November, in connection with the article on "Experiments in Air Conditioning of Separate Rooms?"

New York. R. L. S.

This machine, we find, has never been manufactured on a commercial scale. A few models were built and a company organized by its inventor, Mr. White, under the name of the National Air Treating Co., of Boston. The company was all ready to begin operations when Mr. White died recently. Efforts are now being made to dispose of Mr. White's patents.

Is There Any Saving in Vacuum Heating?

EDITOR HEATING AND VENTILATING MAGAZINE:

A heating system man recently made the flat statement that with his specialties installed the owner could save 20% of the coal required by any similar or good-working vapor heating plant. This contention is based upon the assertion that his "vacuum-maker" is the only thing of its kind on the market and therefore no one else could duplicate the results in a gravity job using thermostatic traps with graduated valves on radiators.

Even if no one else does make such vacuum device, I am not convinced that a vacuum maintained on a gravity heating plant gives any saving over a straight vapor job with thermostatic traps and a return-to-boiler trap at the boiler. I am willing to be shown how the saving is accounted for, because it would be a very worth while proposition and a public benefit. Will not some of the engineers and heating system men who are readers of your journal, as well as experienced contractors who can throw some light on this subject, give their views on this important problem?

For general information I might state that one of the younger men I know, who is pretty handy at figuring, leads me to believe that this claim of a saving by means of a vacuum is merely one of those meaningless talking points that salesmen still insist on using. Here are the figures:

Steam at 10 in. vacuum = 192° F. = 983 B. T. U. latent heat and 1142 B. T. U. total heat. Return water = 172°.

Steam at 0 lbs. pressure = 212° = 970 B. T. U. latent heat and 1150 B. T. U. total heat. Return water = 197°.

Take 1000 sq. ft. direct radiation at 250 B. T. U. = 150,000 B. T. U. Then 250,000 ÷ 970 = 257 lbs. water condensed by steam system, and 250,000 ÷ 983 = 256 lbs. water condensed by vacuum system.

Steam system has to raise water from 197° to 212° = 15°.

Vacuum system has to raise water from 172° to 192° = 20°.

Steam system, therefore, has to supply 257 lbs. × 15 = 3855 B. T. U. and at 10,000 B. T. U. to a pound of coal = 0.3855 lbs. coal.

Vacuum system therefore has to supply 256 lbs. × 20 = 5120 B. T. U. and at 10,000 B. T. U. to a pound of coal = 0.512 lbs. coal used.

These figures favor the straight vapor job, but of course they are purely theoretical and taken on an assumed basis and at 100% efficiency all round. Even if it were possible to circulate steam and have a vacuum at the same time, and then also allowing only a 15° temperature rise for the vacuum system, the coal used would still be 0.384 lbs. which, in practice, is no saving at all. Then, is the vacuum on all the time?

But will some one explain how steam can be generated and circulated under 10 in. or any other degree of vacuum, when it is generally understood that steam breaks a vacuum, instead of making one. Also, do the above figures come anywhere near being right?

New York. INQUIRER.

Corridor Venting.

EDITOR HEATING AND VENTILATING MAGAZINE:

The writer was particularly interested in an article on present-day ventilating practice by Nelson S. Thompson which you published in your April issue, especially his statement favoring corridor venting. It has always seemed to the writer that corridor venting, by which we mean the elimination of all vent flues so that the excess air flow through the building is handled through the corridors, was the application of sound, common sense.

This application is in no way essential to unit ventilator application but it seems to have so many advantages with so few apparent disadvantages that we believe that wherever results of its application are carefully analyzed, the decision must be in its favor.

This is indicated to us by the reports that are coming in from a number of careful business executives of various school boards who are making it their business to visit buildings in which corridor venting has been used.

As an indication of how it works out from a cost standpoint, we mention a recent parochial building in Minneapolis for which two studies were made; one providing for central fan application and the other for unit ventilator application with corridor venting.

The saving on building construction due to the elimination of the warm air and vent flues required by the central fan, and the special building construction that these flues required, was sufficient to pay for the entire unit ventilator installation.

Moline, Ill. J. M. R.

Calculating Hot Water Risers.

EDITOR HEATING AND VENTILATING MAGAZINE:

In the September issue of your magazine, Mr. Wiliam F. Devendorf asks other designers to give their experiences with water-installations similar to those under discussion.

I am a reader of your very interesting magazine and with every new issue I am more amazed at the mechanical perfection of the American heating systems and of the "thumb-ruly" manner of calculation.

The way in which Mr. Devendorf calculates the diameter of the drop riser by computing the areas of the four 1-in. connections of the radiators and what he tells about the water temperature in these four radiators, is in absolute contradiction with theory. The calculation of these diameters and temperatures can be made in one way only and the principles of this calculation are based on solid rock.

Only one type of one-pipe system is used on the continent of Europe and that is the one-pipe water-heating system, with risers, as shown in Fig. 1 of Mr. Devendorf's correspondence. The great advantage of this system is that no cellar is needed. The boiler can be placed on the same floor with the lowest radiators or, in some cases, on a higher story.

What Mr. Devendorf tells about the expansion of the water being the motive power is quite true. It is the difference between the weight of the heated and the cooled water in supply and return that gives the circulating pressure. With the normal two-pipe system the calculation of the pipe dimensions is made in this way, that the total of the circulating pressure will be used in the whole of the circuit, each circuit consisting of the way the water flows from the boiler to the radiator and back to the boiler. Each radiator has also its own circuit and its own circulating pressure. This circulating pressure is calculated by multiplying the vertical distance of the middle of the boiler to the middle of the radiator by the difference of weight between the supply and the return water.

With the one-pipe system, part of the water passing through the radiator on the

top floor passes also through the radiators below. The circulating pressure of the highest radiator accelerates the circulation of the water in the lower ones. The negative circulating pressure of a radiator beneath the center of the boilers diminishes the velocity of circulation in the higher ones. Therefore the circulating pressure of a one-pipe system is the resulting circulating pressure of all the radiators on a riser and not of one radiator alone.

The resulting vertical distance is found by multiplying the vertical distance of each radiator with its B. T. U. and dividing the sum of these products through the sum of the B. T. U. of the riser. The product of the resulting vertical distance times the difference in weight gives the resulting circulating pressure.

The loss of heat by friction, accelerations, etc., in a circuit is always equal to the circulating pressure, produced by the cooling of the water in the radiator. It is the task of the designed to calculate the diameter of the pipes of each circuit so that the acquired velocity (and the degree of cooling and the loss by friction, etc., which are caused thereby) is equal to the velocity needed. Our manner of calculuating is based on a temperature of 30-25° or 20° C., *i. e.*, 54-45° or 36° F.

Two other items are discussed herewith: (a) the circulating pressure, (b) the quantity of water to be passed through each circuit.

Once the quantity of water is known, it is possible to express the velocity in a formula consisting of several known terms and the diameter as the only unknown term. Prof. Rietschel and after him, Prof. Brabbée have calculated the loss of pressure head by friction for many thousands of cases for a given velocity and diameter and a length of pipe of one meter.

The diameters are now calculated on the basis of a constant loss of pressure per meter. This is different from a constant velocity; the loss of pressure is proportionate with the circumference of the section of a pipe, the quantity of water with the area of this section. For a pipe of twice the diameter of another one, the surface of friction will be twice as much, the velocity for the same quantity can be one-fourth. The larger the diameter the larger the velocity can be, with the same loss of pressure.

The manner of determining the diameter of the riser by computing the diameter of the four radiator connections, as based on the idea of constant velocity, gives no constant loss of pressure head. Though this manner of determining the diameter of the riser far from simplifies an accurate calculation of the other diameters, it is not to be called faulty. The consequence, however, is that the whole circuit has to be of much larger diameter than is necessary with an accurate calculation. When trying to obtain a sufficient effect of each radiator, while keeping the dimensions of both radiators and pipes as small as possible, it happens often that not only the diameter of the radiator connections are of the same diameter as the riser, but sometimes a connection of 1 in. has to be made on a riser of ¾ in.

In order to prove this, I will point to another defect in the calculation of Mr. Devendorf. The number of B. T. U. to be transmitted by a radiator, divided by the degree of cooling of the water, gives the pounds of water to be conducted through each radiator. When the four radiators have a total of 45,000 B. T. U. and the cooling is of 45° F., 1000 lbs. of water have to flow through the riser in the course of one hour.

The cooling of the water in the riser will be proportionate to the amount of B. T. U. given off in each radiator. When the radiator in the upper floor gives off 9000 B. T. U. the water flowing to the following radiator, will have a temperature $9000/45000 \times 45°$ F. $= 9°$ F. lower than that of the highest. How much of the total amount of the water flows through the first radiator and how much goes through the bypass is of no influence.

As the diameter of the riser, as well as that of the connection does not appear in the formula, the so-called mixing temperature between the radiators will always be the same. The only way to diminish the cooling in the riser is to increase the total amount of water conducted through the riser. This means to make the whole circuit larger than is necessary and to circulate a large quantity of water through it that passes through none of the radiators. The only advantage lies in the economy of a few per cent. in the heating surface. It is, however, possible to design a one-pipe system wherein the heating surface is but 5% to 10% larger than with a two-pipe system. When all the water of each riser could be conducted through each radiator, the sum of the heating surfaces on a riser would be equal to that of a two-pipe system, the top radiator having an average temperature as much higher than normal, as the lowest one would be lower than normal. To obtain this effect, the radiators would have to be arranged in series. (The arrangement in Fig. 1 is a mixture of series and parallel arrangement). When shutting off one of the radiators the circulation would be stopped for the others also. This could be prevented by the use of a three-way valve, opening a bypass when shutting the radiator off. I have never seen this kind of arrangement.

In order to keep the heating surface as small as possible, the cooling of the water has to be reduced, *i. e.*, more water has to be conducted through. It has been found good practice to pass 75% to 80% of all the water passing through the riser through each radiator. This means, however, that the calculation of the diameter of the connections has to be made separate of the calculation of the circuit.

The force to move the water through a radiator consists of two different parts. The first is the difference in pressure between the tee where the two flows part and the tee where they meet again. This force is practically nothing. With the diameter in the bypass staying the same and 75% of the water passing through the radiator, the velocity in the bypass will be only one-fourth of that in the riser. The loss of pressure due to fricton will be also $(¼)^2$ of the amount in the same length of riser.

The second force consists of the difference in weight existing between the water in the bypass and the cooling water in the radiator. When assuming that the cooling does not take place successively but at once at the middle of the height of the radiator, the secondary circulating pressure, as it is called, is the product of the vertical distance of the middle of the radiator to the return tee and the difference in weight. This also is but a slight force, especially with low radiators and little cooling in the radiator. Moreover the extra resistance in the connections (accelerations and deviations) is many times larger than in the straight bypass. All these causes make a large diameter of the connection necessary. To prevent too large diameters, two remedies can be applied. The first is: providing for a larger degree of cooling. This means larger circulating pressure and less water, but also a larger radiator. The second is a little out of the ordinary: placing the return tee lower on the riser and therewith enlarging the vertical distance. Sometimes this tee is placed below the ceiling of the lower story.

I know of many installations calculated in this way, where the boiler stands on the same floor with the lower radiator, with lengths of circuits of over 150 meters, *i. e.*, 500 ft., which begin to circulate with a temperature of 85° F. on the boiler, every part of the system getting warm in the same space of time.

J. BLANSJAAR.

Amsterdam, Holland.

Pneumonia and Overheated Homes.

Precautions for avoiding the onslaught of pneumonia, now on the increase in Detroit, are given by Dr. Henry F. Vaughan, health commissioner of that city, who states that one way of combating the ravages of this disease during the cold season is to fortify the body against temperature changes. This, he says, can be done by living in cool rooms, by cool morning showers, and by daily walking exercises in the open.

"We have developed a pernicious habit," declares Dr. Vaughan, "of living in atmospheres of 75° to 80°, instead of 65° to 70°. It seems to be a difficult thing to keep cool in winter. Homes are too hot, and so are restaurants, theaters, stores, school rooms and offices."

Sectional Committee Appointed to Draft Gas Safety Code.

Governmental departments, technical societies, insurance companies, manufacturers of gas-making and gas-using equipment, and employers and employees are represented on a Sectional Committee for a Gas Safety Code, which has been appointed by the American Engineering Standards Committee. The code, when formulated, will be issued under the joint sponsorship of the American Gas Association and the Bureau of Standards. The personnel of this committee includes T. F. Hanley of Chicago, representing the National Association of Master Plumbers.

American Society of Heating and Ventilating Engineers

Western New York Chapter Discusses Rating of Low Pressure Boilers

A feature of the November meeting of the Western New York Chapter, held at the Hotel Iroquois, Buffalo, November 6, was a paper presented by Frank B. Howell, director of research of the American Radiator Company, on the rating of low-pressure heating boilers. Nearly 125 members and guests were in attendance.

An outline of the work accomplished by the Research Laboratory of the American Society of Heating and Ventilating Engineers in Pittsburgh was given by Thornton Lewis, Chairman of the society's Committee on Research. The more important investigations now under way are:

1. B. T. U. table of radiation under different conditions.
2. Critical velocities for different size steam pipes.
3. Standard code for testing fans.
4. Practical method for establishing dust in air.
5. Experiments on the human body to obtain line of equal comfort for temperature and humidity.
6. Measurement of heat transmitted through various materials by an *instrument*.
7. Ozone effects.

Director F. Paul Anderson of the A. S. H. & V. E. Research Laboratory was present and addressed the chapter on "The Origin of Fuel." He referred to the different ages of the earth, showing the progress of life. He brought out the fact that fuel consists of two elements only, carbon and hydrogen, and that the different pressures and ages created the various grades. He further stated that we get a very small percentage of available energy from fuel, oftentimes not exceeding 5%. In closing he laid emphasis on the fact that the business of engineers is to learn to burn fuel more economically.

MR. HOWELL'S ADDRESS.

Mr. Howell, at the beginning of his address, pointed out that the English and American societies of heating and ventilating engineers both base the catalogue ratings of all heating boilers on the number of pounds of steam delivered from the flow pipe of the boiler per hour, without driving and without priming. The English and American basis for rating all heating radiators is ¼-lb. of steam condensed by 1 sq. ft. direct radiator surface per hour, when standing in still air at 70° F.

The English and American method of relating the heating boiler steam output per hour with the steam condensed by 1 sq. ft. of radiator per hour is by dividing the former by the latter, the answer being the catalogue rating of the steam-heating boiler. It is the custom to express this rating in square feet of direct radiator surface.

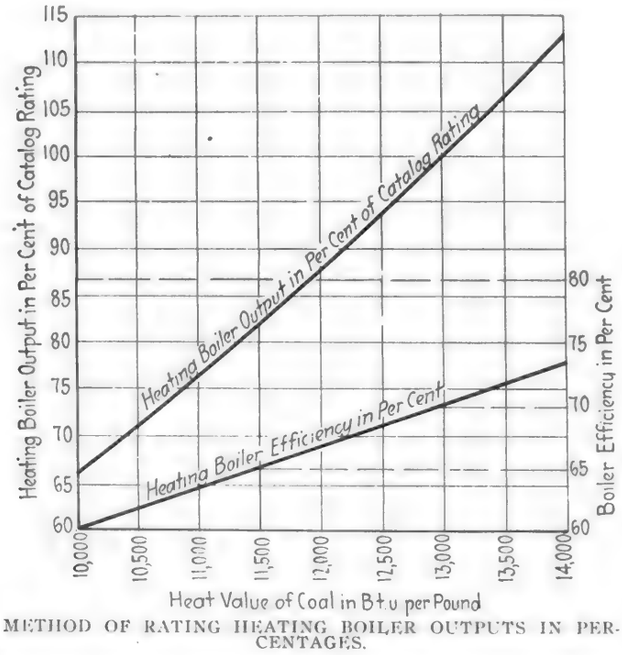
Example: 1000 lbs. of steam per hour delivered from a heating boiler, divided by ¼ lb. of steam condensed by 1 sq. ft. of direct radiator surface per hour establishes 4000 sq. ft. as this boiler's catalogue rating.

The accuracy of the catalogue rating established on the foregoing basis, Mr. Howell maintained, should be certified by the maker of the boiler. If the boiler is in the house-heating class, he added, the maker should certify that the boiler has a coal capacity sufficient to deliver its catalogue rating for 8 hrs. with one fuel charge, indefinitely.

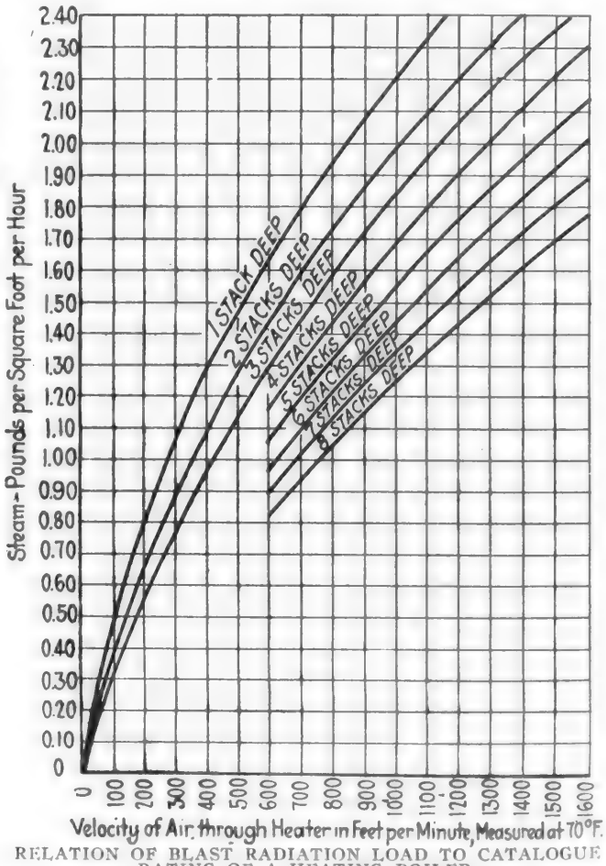
Mr. Howell pointed out how heating boilers are called upon to burn every conceivable kind of fuel the country over. On this account, he said, it is impossible to establish standard reliable catalogue ratings without using, when testing, a fair grade of coal. The average value of such a grade is 13,000 B. T. U. per pound. Notwithstanding that many mines produce soft coal of 14,500 B. T. U. and over, coal having an average of 13,000 B. T. U. is generally used when testing heating boilers to establish their catalogue rating.

As all heating boilers have but one catalogue rating, developed from coal averaging 13,000 B. T. U., the use, when in service, of coal having a greater or a less heat value than 13,000 B. T. U. per pound enables the heating boiler to deliver from its flow pipe a greater number or a less number of pounds of steam per hour, according to the quantity of heat units per pound contained in the coal.

It is the custom, continued Mr. Howell, to express and describe these varying heating boiler outputs in percentages greater or less than 100%, or catalogue rating as shown on the accompanying drawing. In this drawing the two curves shown are composites of several curves


Heating Boiler Output in Per Cent of Catalog Rating
Heating Boiler Efficiency in Per Cent
Heating Boiler Output in Per Cent of Catalog Rating
Boiler Efficiency in Per Cent
Heat Value of Coal in B.t.u. per Pound

METHOD OF RATING HEATING BOILER OUTPUTS IN PERCENTAGES.


Steam-Pounds per Square Foot per Hour
1 STACK DEEP
2 STACKS DEEP
3 STACKS DEEP
4 STACKS DEEP
5 STACKS DEEP
6 STACKS DEEP
7 STACKS DEEP
8 STACKS DEEP
Velocity of Air through Heater in Feet per Minute, Measured at 70°F.

RELATION OF BLAST RADIATION LOAD TO CATALOGUE RATING OF A HEATING BOILER.

of similar character compiled from testing a number of large cast- iron heating boilers at different steam output rates, and with soft coal having different heat values.

Example: Soft coal containing 13,000 B. T. U. per pound develops catalogue rating, or 100% at an efficiency of 70%, while soft coal containing 12,000 B. T. U. per pound develops but 88% of catalogue rating at an efficiency of 67%. Soft coal containing 11,000 B. T. U. develops but 76½% of catalogue at an efficiency of 63½%.

In another example Mr. Howell showed how a heating boiler catalogue-rated at 10,000 sq. ft., when burning soft coal containing 11,000 B. T. U. per pound, will develop an output of but 76½% of 10,000 sq ft., or 7,650 sq ft. If the heating load calls for a boiler having a catalogue rating of 10,000 sq. ft.—and soft coal containing 11,000 B. T. U. per pound is to be used—then a heating boiler having a catalogue rating of 13,010 sq. ft. is necessary.

The speaker then presented a drawing showing the relation of a heating or a ventilating load of blast radiation to the catalogue rating of a heating boiler, and offered the following example:

With steam in the blast radiation of 5 lbs. pressure, or 227° F., and air to be warmed entering at zero and leaving at 100° F. (for air at 70°) and traveling at a velocity of 1200 ft. per minute through four stacks of blast radiation, there would be required 1 92/100 lbs. of steam per square foot of blast radiation per hour. Dividing this by ¼-lb. of steam (the English and American basis for rating all heating boilers) would constitute a tax equal to 7 68/100 ft. of regular column radiation.

In accordance with the foregoing a heating boiler having a catalogue rating of 10,000 sq. ft. steam, burning soft coal containing 13,000 B. T. U. per pound, will carry indefinitely a load of 10,000 sq. ft. of direct column radiation or its equivalent. Or, burning soft coal containing 11,000 B. T. U. per pound, it will carry indefinitely a load of 7,650 sq. ft. of direct column radiation or its equivalent, or 1000 sq. ft. of blast radiation, when same is in full use under all of the conditions previously mentioned.

Philadelphia Chapter Discusses the Weather.

The fact that the Philadelphia Chapter could find nothing more important to discuss at its November meeting than the weather is not to be taken as indicating any lack of initiative on the part of the program committee. As it happened this particular discussion was on "manufactured" weather and was opened by E. T. Murphy, vice-president and Philadelphia manager of the Carrier Engineering Corporation.

He analyzed the workings of the physchrometric chart, giving a very clear idea of its use. His talk was illustrated by lantern slides.

Eighty-five members and guests were present when President Frederick D. Mensing called the meeting to order in the Engineers' Club.

Massachusetts Chapter Debates Fan Systems of Ventilation Versus Unit Ventilators.

A live subject was up for discussion at the November meeting of the Massachusetts Chapter, held in Lorimer Hall, Tremont Temple, Boston, November 13, when leading exponents of the fan system and of the unit system presented their views. The speakers were J. M. Robb, of the Herman Nelson Corporation, for the unit ventilator side, and Fred R. Still of the American Blower Company and R. E. Shaw, of the B. F. Sturtevant Company for the fan system side. The other scheduled speaker for the unit ventilator, M. J. Callahan of the Peerless Unit Ventilator Company, was unable to attend the meeting.

Some 125 members and guests were present when President J. F. Tuttle opened the meeting. He turned over the gavel to W. T. Jones, the meeting chairman, who introduced the speakers, stating that each speaker would have 35 minutes to present his arguments and ten minutes for rebuttal, at the conclusion of which there would be a general discussion.

J. M. Robb, who was the first speaker, showed some stereopticon views of unit ventilators and explained their operation. He went into details regarding the compactness, durability and efficiency of this kind of apparatus and told about the success of many installations of which he had personal knowledge. He compared the practical application of the unit ventilators with the central fan system, pointing out what he termed the greater flexibility of the unit system, its sanitary characteristics, the superior atmospheric conditions obtained with its use, the better distribution and its more economical operation.

F. R. Still, speaking for the fan system, gave figures to show the advantages of central control over unit control, especially in respect to economy of operation, noiselessness, and the production of more healthful and agreeable conditions. His calculations showed the same steam requirement for both systems when heating a given amount of air and pointed out that power and attendance requirements were less for the central system, that there was less likelihood of operating failure, that air conditions could be more effectually controlled, and that the distribution was better when air is introduced from several sources. He mentioned the lower maintenance cost of central systems, and concluded by saying that unit ventilators are good commercial propositions but could not be recognized as an effective means of ventilation.

R. E. Shaw explained that so many points covered in his paper had been included in Mr. Still's talk, that he would read only a few paragraphs. He gave some figures on the cost of unit ventilators to do the same work as a central system. He quoted figures on temperature and humidity conditions in favor of central systems and cited certain unsanitary features of the unit ventilator from actual experience.

All of the speakers decided to rest on the arguments presented and then answered questions asked by members of the audience. At the conclusion of a lively discussion, a rising vote of thanks was given to the speakers.

The meeting was preceded by a dinner at Youngs Hotel, with 35 present, at which the speakers of the evening were guests of the chapter.

New York Chapter Inspects Plant of American Radiator Company.

Sixty members of the New York Chapter of the American Society of Heating and Ventilating Engineers were guests of the American Radiator Company, at its plant in Bayonne, N. J., on the occasion of the chapter's November meeting, November 20. The party was first entertained at luncheon at the Bayonne Chamber of Commerce where the members were greeted by W. M. Cosgrove, manager of the company's New York branch and J. Barnum, assistant manager.

It was a jolly but hungry party that sat down to luncheon in the board room of the Bayonne Chamber of Commerce. After an appetizing repast the party was ready for the ride to the plant. Before starting, however, the members were formally welcomed by Mr. Cosgrove and by President George A. Keenan of the local Chamber of Commerce, who is also president of the Bayonne Supply Company.

Arriving at the American Radiator Company's plant the party was welcomed by Works Manager F. Strauss who escorted the members through the plant. At present it is devoted exclusively to the manufacture of Ideal radiators. Starting at the core room, the members were shown the various operations, including the casting, tumbling and assembling. The interesting fact was brought out that the daily melting of iron averages 175 tons.

Following the inspection the chapter held its regular monthly meeting in the office quarters of the plant, where the main subject for discussion was the A. S. H. & V. E. Guide for 1923. J. E. Bolling, chairman of the 1923 Publication Committee, presented details of the plans for the second edition of the Guide, stating that a number of firms which had not been represented in the first edition had already expressed their desire for space in the new edition. In response to his solicitation of suggestions and criticism, Champlain L. Riley expressed the opinion that in lieu of a section for the cards of consulting engineers, the names of such engineers should be printed in a separate section free of charge, with definitive listings of their particular branches. Another suggestion was that future editions be printed on a lighter weight of paper so as to make the volume more easily handled. A. V. Hutchinson, manager of publications for the A. S. H. & V. E., presented statistics of the 1922 Guide, showing that the net profit from its publication was nearly $1200.00. There is a steady demand for the volume, it was stated, on the part of both engineers and architects.

Charles V. Haynes told of the plans that are going forward for holding the annual meeting of the society in Washington in January and bespoke the interest of the members in making possible the entertainment program that is being planned.

When adjournment was reached, the sentiment was general that the chapter had spent an unusually profitable, as well as enjoyable, afternoon.

The New York Chapter's meeting programme for 1922-1923 has been issued. In addition to the meetings already held, those for the balance of the season are as follows:

December 18—Group Heating of Buildings. Speaker, George B. Nichols, of Henry R. Kent & Co., who will show lantern slides and describe the central heating plant recently installed at Cornell University.

January 22, 1923— Pre-convention meeting, with entertainment of visiting members *en route* to Washington, James A. Donnelly in charge.

February 19, 1923—Recirculation of Air. (Speaker to be announced.)

March 19—Cooling and Dehumidification. Speaker, President Willis H. Carrier, of the New York Chapter.

April 16—Return Pipe Sizes. Speaker, M. William Ehrlich.

May 21—All-Day Outing. Committee in charge: Budd K. Strader, chairman; Charles A. Miller, William G. LeCompte and H. G. Issertell.

Kansas City Chapter Hears Talk on Central Station.

David Caleb, of the Kansas City Power & Light Company, was the principal speaker at the November meeting of the Kansas City Chapter, held November 8 at the Kansas City Club. His paper was entitled, "Heating of Buildings from a Central Plant," and it was discussed by Messrs. Nottberg, Campbell, Kitchen, Downes, Natkin, Pines, Cook, Russell and Millis.

Under reports of officers, President Stackhouse reviewed the President's Round-Table meeting, making special mention of the Allied Charities and Near-East Relief drives.

President J. R. McColl and Secretary C. W. Obert, of the society, were present as guests. President McColl spoke of the activities of the A. S. H. V. & E. Research Laboratory, while Secretary Obert told of the "equal comfort" investigation that is being carried on at the Research Laboratory. He also mentioned other investigations in connection with ventilation, ozone, critical velocities, boiler performances, etc., and discussed the efforts being made by the Research Laboratory to get fundamental data.

Professor Calderwood, head of the Mechanical Engineering Department of the Kansas State Agricultural College, was present and spoke briefly on the tests of automatic ventilators which have been carried on at the university.

Chairman Dodds of the membership committee announced that five proposals for membership had been received.

NATIONAL DISTRICT HEATING ASSOCIATION

Dates Announced for Next Annual Convention.

Dates for the next annual convention of the National District Heating Association were fixed at a recent meeting of the association's executive committee, which was held in Chicago, October 19. It was decided to hold the convention June 20-23, 1923, at Cedar Point, O., where this year's convention was held. The opening day will be Wednesday, giving the members an opportunity of clearing up their work at home the first part of the week. The sessions will be continued into Saturday, June 23.

H. R. Wetherell Appointed Technical Secretary of the Association.

A step designed to make the National District Heating Association of greater usefulness to its members has been taken in the appointment of H. R. Wetherell as technical secretary. While having the designation of technical secretary, Mr. Wetherell will act in an editorial capacity, his duties including the securing and preparing of additional matter for the N. D. H. A. Handbook, as well as for the association's *Bulletin*. Mr. Wetherell will begin his new duties January 1, 1923, although he will only act on a part-time basis, so that it will not affect his regular business activities.

Needs of the Central Station Heating Companies.

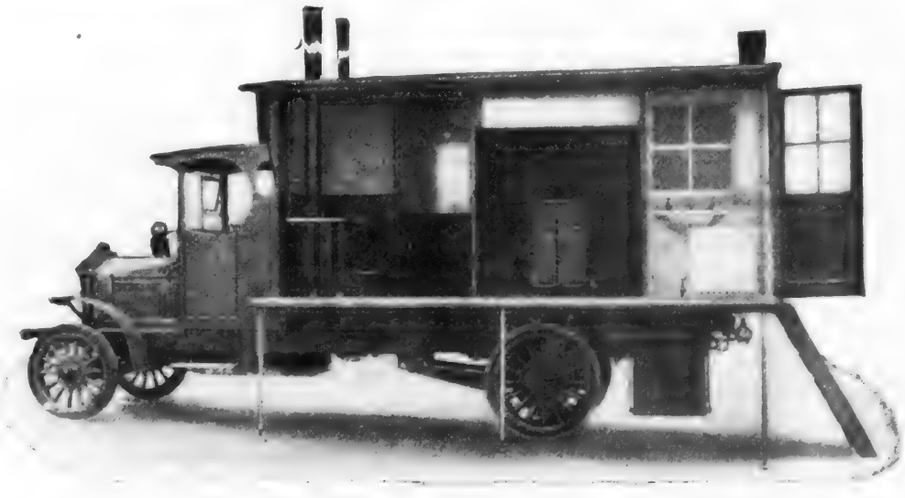
An analysis of the needs of the district heating companies, made by the Public Policy Committee of the National District Heating Association, indicates that most companies need better general engineering data and service. The report gives the needs in detail as follows:

1. They need to know the actual performance of their utilities.
2. They need a knowledge of the possibilities of their existing plant and distribution (100% ideal performance).
3. They need to know the actual possibilities of the territory which they serve.
4. The heating industry should not be considered as a side issue and be expected to operate successfully with second-hand or other equipment which is not economical. In other words, they need economical generating plants just as surely as the electrical industry.
5. The distribution system should be as economical as practicable.
6. The operating organization in both the plant and in the operation of the distribution system should be most efficient and effective.
7. They need the proper attitude of both their own officials and of the public whom they serve. A clean-cut organization operating on an efficient and paying basis will secure the former; fair dealing, due consideration and courtesy, the latter.

A Traveling House-Heating Exhibit.

Something unique in the way of a publicity scheme has been devised by the National Radiator Co., Ltd., of London, England. It is in the form of a portable radiator heating system, mounted on an automobile truck. The exhibit has been used with much success at agricultural shows and wherever such a practical exhibit can be shown.

The exhibit is considerably more complete than shown in the illustration which is published through the courtesy of *The Plumber and Journal of Heating*, of London. The van or "house" portion is divided up to show available conveniences in six rooms. The range used is a No. 1 Ideal Cookanheat and besides serving for cooking purposes supplies hot water to two radiators and also heats a hot water supply. In an adjoining section or room is an Ideal Classic boiler which is coupled up for the same duty. The storage tank (indirect) for the domestic supply will be seen on top of the truck, while an expansion tank is placed on the roof at the rear. The installations are quite complete for daily working demonstrations when on exhibition duty, two demonstrators being in attendance.



TRAVELING HOUSE-HEATING EXHIBIT.

National Trade Extension Bureau

Sales Promotion Events for 1923.

Among the important actions taken at the recent conference of the National Trade Extension Bureau at its headquarters in Evansville, Ind., was the tentative adoption of a program of sales promotion events for 1923. According to this schedule the sales drives will be arranged in the following order:

January—Better Public Relations, to be stimulated by T. E. B. through the heating contractor or plumbing dealer and through the following channels: (1) urge dealers or contractors to improve location of store; (2) to fix up his own store and its exhibits of heating and plumbing; (3) to supply his own home with modern heating, plumbing, water supply and regulating devices; (4) to seek to give quality services only; (5) to emphasize importance of effective show windows, with appropriate display cards; (6) to price publicly the merchandise on display; (7) to adopt accurate accounting, as established by T. E. B. systems; (8) to aim at safe profits through correct estimating as outlined by T. E. B. methods; (9) to ground the trade thoroughly in knowledge of means for increasing volume of business and greater profits of quick turnover; (10) to study statistics to be supplied through T. E. B. Bulletin service, on new buildings, and sales in related industries; (11) to study similar opportunities regarding old buildings; (12) to interview and interest local health officials that progress in heating and plumbing methods and devices may be made fully known to said officials; (13) to agitate by personal appeals and through local legislation for better heating and plumbing in public places; (14) to secure closer cooperation with public utilities; (15) to maintain a file of sales prospects, as per the Inspection Card issued by the T. E. B.; (16) to employ these same cards through his own journeymen and office people reporting on any premises inspected or repaired and to adopt the plan of paying a small bonus to such employees for sales cooperation; (17) to adopt a plan of regular or consistent advertising based on percentage of total volume of business; (18) to invest this advertising percentage or allotment in local or suburban newspapers, outdoor signs, bulletin boards, street-car cards, movie slides or the like; (19) to use illustrations in all advertising matter as supplied by T. E. B. or associated manufacturers, putting out no advertisements without illustrations; (20) to put prices in advertisements as far as possibly can be done (21) to consider and, where possible, adopt cooperative advertisements of the series prepared by T. E. B. for group or association use; (22) to secure reading articles in news columns of local papers, said articles to be supplied by T. E. B.; (23) to adopt system of regular mailing of circular letters, accompanied by circulars, stuffers and catalogues supplied by manufacturers associated with T. E. B.; (24) to conduct regular periodical store meetings of his own people, inviting manufacturers and wholesalers' representatives to be present to explain construction and uses of product, in order to make all his organization better salesmen and to insure correct operation of the merchandise when installed; (25) to pledge, above all other efforts, the personal solicitation or follow-up of all inquiries supplied him by the manufacturers and jobbers of the T. E. B.; (26) to keep in close touch with local building permit authority; (27) to pledge support of the various monthly drives conducted by the T. E. B.

February—Better Sanitation in Public Places.

March—Heat by Radiators.

April—Bath in Every Home.

May—Hot Water for Every Need.

June—Bath-a-Day.

July—Follow-Up or Clean-Up on Inquiries by Personal Calls.

August—Running Water on the Farm.

September—Heat Regulation (gauges, air valves, temperature regulators, and water regulating valves).

October—More and Better Water Closets (National Good Health Week).

November—Get Ready for Christmas Business (Clean up all unsettled prospects of previous months).

December — Domestic Appliances as Christmas Gifts.

Acting on a suggestion of Louis Bruch, of the American Radiator Company, a revision was made of the Premise Report Card. This will be replaced by an "Inspection Report" Card. It will be of the same size and general nature as the present Premise Report card.

Another action taken at the conference was the adoption of uniform sizes for catalogue binders. A committee was also appointed to suggest a general slogan for the entire trade, to be introduced and popularized by T. E. B. Another committee was formed to manage a concerted drive by manufacturers, wholesalers, dealers and contractors in some community as a "test" city.

Eight Methods of Improving Credits.

In the business of the average heating contractor, as the National Trade Extension Bureau points out in its T. E. B. Monthly Service Bulletin, there are few things of greater importance than credits. Credits either mean bigger business, better prices and an "edge" over other competitors, or they mean lost sales, the purchase by customers of more goods than they can afford, too much time consumed in collecting, increased cost of doing business, dissatisfied customers, jeopardized financial standing and lost money.

As the result of an extended survey of the situation, the National Trade Extension Bureau suggests eight methods of improving credits, all of which have been reported as effective. The methods are varied to apply to old residents, newcomers, farmers, merchants, wage earner or salaried man. In the case of an old resident the procedure recommended is to secure answers to the following:

a. How does he pay his bills?
b. Have any other merchants had trouble in collecting their account from him?
c. Have you ever had any trouble with him?
d. Is he considered prompt, medium or slow pay?
e. Is he prejudiced against business men?

If a newcomer, the points to be covered are:

a. Where did he come from?
b. What business was he in there?
c. Did he leave there owing any bills?
d. What was his reputation there?

If the customer is a merchant the following information is needed:

a. Has he been in business long enough to determine whether he is successful?
b. Has he sufficient capital?
c. Is he careful in his own credits to customers?
d. Does he pay his bills regularly?
e. Is there much competition in his line?
f. Does he keep well insured?
g. Is his business increasing or decreasing?

Finally, if dealing with a wage earner or salaried man, answers are needed to the following:

a. Does he own his home?
b. What salary does he get?
c. Has he an economical or extravagant family?
d. Does his family cooperate with him?
e. Has he a savings account?
f. Does it take all he can earn to support his family?
g. Has he a permanent position?
h. Is his work steady the year around?

A form is offered by the National Trade Extension Bureau for a statement of the customer's financial condition which the bureau advises contractors to use as a basis for establishing credit on contracts for old and new buildings. Other points that should be taken care of before starting a given piece of work are: Considering credit the same as loaning the money, having a definite understanding at the time of making a contract or sale, the careful filing and recording of all agreements, being frank with your customer in the matter of credits, definitely arranging for payment as the work progresses and getting a proper view of the credit department as more useful in helping the contractor to keep out of trouble through bad debts than in helping to collect old accounts.

An Inside Chapter of Business History.

Some of the romance surrounding the rise of the Hoffman radiator vent valve is told in advertising copy of the Hoffman Specialty Company which is appearing in a number of periodicals. The names of the principals are disguised, but otherwise the facts are as stated. As the story goes:

On a dull April morning, in 1913, George D. Hoffman arrived in Chicago with a valve in his pocket and very little else. His destination led him down

through the busy, teeming streets of the old West Side.

Entering a huge brick building, Hoffman asked for Mr. Nickel, vice-president and purchasing agent. It was characteristic that Hoffman should seek the biggest man in the biggest business of its kind in the country; a distributing concern which sold heating equipment wherever heat is needed; an organization whose branch offices dot the cities of the world.

After a short wait, Hoffman was ushered into an office where Nickel sat behind a big desk, frowning over his papers. Finally, the vice-president glanced up and smiled, as he recognized the short, sturdy, earnest man who stood quietly before him. He stretched out his hand. "'Lo there, Hoffman! Glad to see you. What's on your mind?"

Hoffman slowly drew the valve from his pocket and placed it on the desk. "Here's a new radiator air valve for steam heating systems. It's my own valve. I want you to buy it."

"Hum!" said Nickel thoughtfully. "If you made it, it ought to be good. But—" he shrugged his shoulders "you know how we're fixed—practically tied up to The Universal Radiator Company. All our branch houses are stocked with their valves. It's a good valve, too. In fact—" with a grin, "if I'm not mistaken you personally sold 'em to us in the first place. I don't see just why we should buy your valve, Hoffman—do you?"

"Mr. Nickel," said Hoffman very quietly, "you can't afford *not* to buy my valve," and pausing as though to measure every word, "You can't afford not to buy it because within the next few years this valve is going to save thousands of tons of coal for people with steam heating systems. It's going to give them a degree of heat-comfort they've never had before. It will function as no other valve will. It is absolutely in a class by itself."

"That's tall talk, Hoffman!" objected Nickel. "Can you prove what you've said about this valve?"

"Yes!" replied Hoffman.

Nickel rose, picked up the valve, and said shortly, "Suppose you come upstairs with me."

They climbed two flights of stairs and entered a room filled with pipes, and gauges and the sound of steam. The temperature was tropical. A tall man in shirt sleeves rose and approached them.

"Mr. Hoffman, this is Ed Wilson our chief engineer," said Nickel. The two men shook hands.

"Mr. Hoffman," explained Nickel, "has a radiator vent valve that he says is a world-beater. And he claims he can prove it. I want you, Ed, to test his valve in every way possible and give me a report."

As Nickel started for the door he called over his shoulder, "How's that, Hoffman, all right?" But Hoffman didn't even hear him. Already he had his coat off, and turning to Wilson, said briskly, "First thing I want, Mr. Wilson, is to have a radiator set up here; arranged so we can reproduce exactly the conditions which exist on a radiator in actual operation. Then I want to send out and get every single make of valve you can find."

Late that afternoon, the experimental radiator was in operation and Wilson's men had returned with every known radiator air valve.

Three solid days and a good part of three nights, Hoffman and Wilson tested and re-tested and recorded. Steam and water and air were shot into that radiator.

Some of the valves failed to prevent the escape of steam and the radiator hissed in that disagreeable way you've often heard. Other valves sputtered and dripped and leaked water. Others failed to vent all the air from the radiator (a costly failure that piles up the coal bills) And most of the time the radiator pounded and banged and rattled like an untamed flivver. But there was one valve which consistently and unfailingly performed every operation perfectly. One valve that was in a class by itself. And that valve was the one Hoffman had carried in his pocket all the way to Chicago.

As a result of these tests Wilson's report to Nickel said, "Everything Hoffman claims for his valve is true— and a little bit more." And as a result of this report Nickel gave Hoffman an order which staggered him and a letter to all his branch offices, briefly telling of the tests and instructing them to see Hoffman.

"Is that fair enough?" he asked as Hoffman was leaving.

"Just one more thing," Hoffman replied. "May I use your letter to your branch offices to get other business:"

"Go as far as you like!" said Nickel cheerfully. "And good luck!"

It was that leter that made Hoffman. Armed with the approval of one of the biggest men in the business Hoffman literally swept the country.

Within a year of the Chicago visit, he was flooded with letters from home owners, engineers and dealers all over the country. Letters which read—"Your valves cut a third from my coal bill." "Radiators are now 100% hot and absolutely silent." "More than paid for the valves the first winter through the coal they saved." And then one day came a letter which said, "We call your valve The Watchman of the Coal Pile." And the name was so appropriate it stuck.

New Publications

STANDARD CODE REGULATING THE INSTALLATION OF WARM-AIR FURNACES IN RESIDENCES has now been approved and issued by authority of the National Warm-Air Heating and Ventilating Association, National Association of Sheet Metal Contractors and the Western Warm-Air Furnace and Supply Association. The name of the American Society of Heating and Ventilating Engineers, which appeared on the tentative draft as first printed, is now omitted, due to the fact that the A. S. H. & V. E. withheld its approval of the code, as already reported in these columns. Article 2, to which objection was made by members of the A. S. H. & V. E. on the ground that it did not permit sufficient room for the installation of proper-sized pipes, reads as follows:

Section 1. (a) The following provisions shall be made by the owner or building contractor, in any building wherein a warm-air heating plant is to be installed.

(b) Where warm-air register boxes heads, pipes or stacks are to be installed, joists shall be set not less than sixteen inches (16") on centers and shall be butted and not lapped. Studding shall set directly over and under joists, leaving a space of not less than fourteen inches (14") between studs and joists. Wherever joists are cut, headers must be put in to support joists.

(c) All first story single or sub-floors shall be continuous. In all houses having studded exterior walls, these floors shall be extended to the outside sheathing and all spaces between studding shall be closed at the attic line.

Note 1. It is strongly recommended that the attic be tightly floored to reduce heat losses.

(d) All partition walls (or sections of these walls) in which heat stacks to second floor rooms are to be installed, shall be built of six-inch (6") studding to second story floor joists.

The formulas for determining the size of warm-air pipes, wall stacks and furnaces for use in a residence are given as follows:

Method of Determining Size of Basement Warm Air Pipes.
(Read Explanatory Notes 4 to 11)

Section 1. First Floor Rooms.

Divide square feet of glass by 12,
Divide square feet of net wall by 40,
Divide cubic contents by 800,
Add together the above and multiply by 8.
The result is the area of the basement pipe.

The sum of:

Glass (sq. ft.) (*Note 4*)	÷ 12
Net Wall (sq. ft.) (*Note 5*)	÷ 40
Cubic Contents	÷ 800

Multiplied by:
8 = Area of Basement Pipe (*Note 10*)

Section 2. Second Floor Rooms.

Divide square feet of glass by 12,
Divide square feet of net wall by 40,
Divide Cubic contents by 800,
Add together the above and multiply by 6.
The result is the area of the basement pipe.

The sum of:

Glass (sq. ft.) (*Note 4*)	÷ 12
Net Wall (sq. ft.) (*Note 5*)	÷ 40
Cubic Contents	÷ 800

Multiplied by:
6 = Area of Basement Pipe (*Note 10*)

Section 3. Third Floor Rooms.
Divide square feet of glass by 12,
Divide square feet of net wall by 40,
Divide Cubic contents by 800,
Add together the above and multiply by 5.
The result is the area of the basement pipe.

The sum of:

Glass (sq. ft.) (*Note 4*)	÷	12
Net Wall (sq. ft.) (*Note 5*)	÷	40
Cubic Contents	÷	800

Multiplied by:

5 = Area of Basement Pipe (*Note 10*)

Method of Determining Size of Wall Stacks.

Section 4. First Floor Rooms.
Same as Section 1.

Section 5. Second Floor Rooms.
Deduct 40% from basement pipe area determined in Section 2.

Section 6. Third Floor Rooms.
Deduct 40% from basement pipe area determined in Section 3.

Explanatory Notes.

Note 4. In obtaining glass surface use full casement opening. An outside door is figured as glass.

Note 5. To obtain net outside wall multiply height by width and deduct the glass in all windows and outside doors.

Note 6. For rooms having unusual exposure, ordinarily north, northeast and northwest, add 15% to pipe area. For east and west exposure, add 10%.

Note 7. For cold ceilings, add one-half net area of ceiling to net exposed wall (cold ceilings are those next to unfloored attics.)

Note 8. Use no warm air pipe less than 8 inches in diameter.

Note 9. It is understood in using the above values for determining basement warm air pipe areas, that these pipes should be run comparatively straight and that they should not be over 10 to 12 ft. in length. Sharp turns and long pipes should have extra capacity.

Note 10. These formulae are for 70° inside temperature with zero temperature outside. For a temperature of 10° below zero, add 10% to the capacity of each pipe.

Note 11. The value of 800 (used in cubic contents) is for an estimated air change of one room volume per hour. If it is desired to provide for 1½ room volume use the figure 600. If for 2 room volume use the figure 400. The factor of 8 in Section 1 will give a register temperature of approximately 190° in zero weather. Should a lower register temperature be desired, the factor 9 will give 175° at the register.

VALUE OF COKE, ANTHRACITE AND BITUMINOUS COAL FOR GENERATING STEAM IN A LOW-PRESSURE CAST-IRON BOILER," is the title of a timely paper just issued by the U. S. Bureau of Mines, under the authorship of John Blizard, James Neil and F. C. Houghton. The primary purpose of the tests described in this paper was to determine the relative steaming values of coke, anthracite, and bituminous coal when burned in a low-pressure boiler, and fired by hand in fairly large quantities at a time.

A secondary purpose of the tests was to separate the heat losses, and to examine them carefully to determine the change in efficiency with the method of firing the fuel and manipulation of the draft dampers, with the rate of evaporation, and with the various fuels burned.

Other purposes were the determination of the draft used, temperatures and composition of the gases in the flues, furnace, and combustion chamber, and other factors affecting the operation of the boiler.

Before these tests were completed, some special tests were run at the request of the Chamber of Commerce of Pittsburgh, to compare the steaming value and smoke emission of mixtures of coke breeze and Pittsburgh coal with those of the latter alone; results of these tests are also embodied in this report.

Tests were made at different rates of steaming with coke, anthracite, and bituminous coal. Two tests also were run with a mixture of equal weights of bituminous coal and fairly coarse coke breeze, and two more with a mixture of equal weights of bituminous coal and a finer coke breeze. The calorific value of the coke ranged from 10,700 to 11,900 B. T. U. per pound; of the anthracite from 11,700 to 13,300 B. T. U., of the bituminous coal from 12,900 to 13,900 B. T. U., and of the coke breeze-bituminous coal mixture from 11,200 to 11,800 B. T. U., The bituminous coal contained less ash than the coke or anthracite, about the same proportion of moisture, and, of course, far more volatile matter.

The mean steaming values of the coke, anthracite, and bituminous coals were about the same. At the low rate of steaming the coke and anthracite evaporated more water than the bituminous coal, and at the higher rates of steaming the bituminous coal evaporated more water than the coke or the anthracite. The steaming value of the mixture of the coarser coke breeze and bituminous coal was about 80% of that of bituminous coal alone, whereas the mean steaming value of the mixture of finer coke breeze and bituminous coal was lower than that of the mixture of coarser coke breeze.

Technical Paper 303 may be obtained from the Bureau of Mines, Washington, D. C.

New Home-Study Course in Heating and Ventilation.

Included in the ambitious program of home-study courses which have been developed by the Extension Division of the United Y.M.C.A., Schools, is one on heating and ventilation. This course has been designed to meet the demands of architects, engineers and contractors, as well as their assistants, who are interested in the proper design of heating and ventilating systems. A review of mathematics is given to prepare the student for the various interesting calculations. Elementary physics of mechanical and heat energy and elementary chemistry of fuels and combustion are included, as well as a general training in drawing. However, students may be excused from this preliminary work by satisfactorily passing an examination.

Following is the full list of the subjects covered: Essentials of drafting; arithmetic, geometry, algebra, trigonometry, reading of drawings, reading of heating and plumbing plans, chemistry, physics, and heating and ventilation. Under the last heading will be taken up physical units and measurement of heat; properties of water, steam and air; heat transmission of building construction; heat transmission of direct radiators; radiators for direct heating; fuels and combustion; steam-heating boilers; water heating; heating water in tanks and pools; drafts and chimneys for heating; ventilation air analysis and ventilation laws; gravity indirect heating by steam and hot water; warm-air furnace heating; fan-blast heating; air conditioning; air washing; humidifying; cooling; drying; temperature and humidity control; exhaust steam heating; central station or district heating; pipe fittings, valves and coverings; and estimating.

The cost of the course, including a complete drawing outfit, is $125.00. The headquarters of the United Y.M.C.A., Schools are at 375 Lexington Avenue, New York.

H. P. Gant Nominated for President of Heating Engineer's Society.

A revision of the list of nominees for office in the American Society of Heating and Ventilating Engineers has been found necessary, due to the fact that a provision of the society's constitution reads that "a president or vice-president shall not be eligible for immediate re-election to the same office at the expiration of the term for which he was elected."

In the original ticket H. P. Gant was nominated first vice-president, an office which he now holds. In the revised ticket, the names of the nominee for president, Homer Addams, and H. P. Gant have been reversed, so that the nominations now stand as follows for the first two offices:

For president, H. P. Gant, of the engineering firm of Lewis, Robinson & Gant, Philadelphia; and for first vice-president, Homer Addams, Kewanee Boiler Co., New York.

Deaths

CHARLES J. TAGLIABUE, president of the Charles J. Tagliabue Mfg. Co., Brooklyn, N. Y., manufacturer of thermometers, recording and indicating instruments, etc., died November 2. He was 70 years old. Mr. Tagliabue designed many of the instruments marketed by his company and was one of the old-time figures in the trade.

FREDERICK HERBERT BOARDMAN, vice-president of the J. D. Johnson Co., and manager of the company's Brooklyn plant, died suddenly October 24 while playing golf. He was 59 years old and had been connected with the heating and plumbing supply house of J. D. Johnson Company since the time he was 24 years old. During that period he rose from a minor position to be one of the prncipal executives in the firm.

CECIL R. LAMBERT, president of the Cecil R. Lambert Co., Detroit, Mich., manufacturers' agents, was killed in Chicago recently while riding in a taxicab. His car was struck by a speeding sedan which turned out to be a stolen car. Mr. Lambert was crushed underneath the taxicab. He was 35 years old. His father, Charles R. Lambert, who died about a year ago, was president of the Clayton & Lambert Mfg. Co., Detroit.

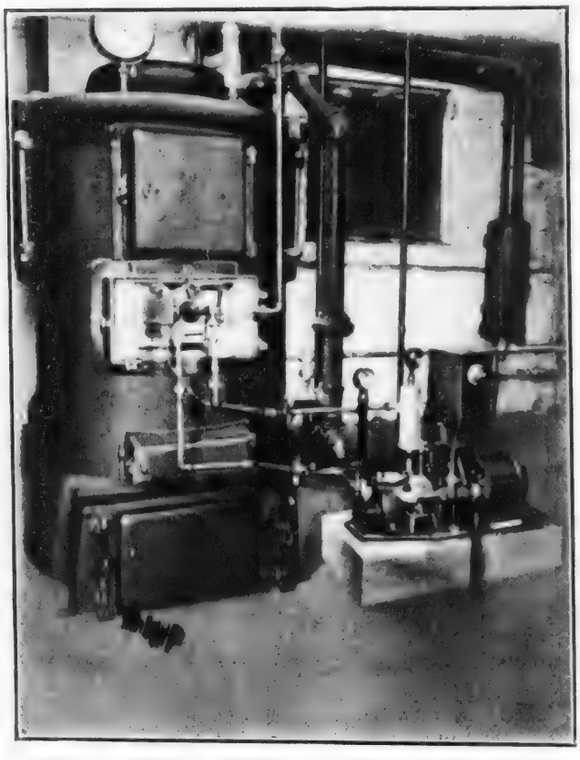
Types of Fuel-Oil Burners For Household Use

IV—Victor Automatic Oil Burner

The principle of atomization of oil is not new, nor is its application, so that the distinctions to be found among the various makes of oil-burning apparatus have to do largely with the design of the atomizers themselves. This is especially true of the Victor oil burner, which is manufactured by the Victor Oil Burner Co., 111 West Washington St., Chicago, Ill. In this device the compressed air required to aid the nozzle in its work is obtained from the power units of the equipment. The unit itself is a combination of oil pump, air compressor and electric motor, with the necessary auxiliary fittings.

The pump unit consists of a motor, air compressor and oil pump, axially connected on a rotating shaft and mounted on a cast-iron base and concrete block, the concrete block itself resting upon a bed of heavy felt. Above the motor is mounted a relay box containing the master switch, which connects with the various controls, namely, the thermostat, boiler control and pilot light. The motor drives the air compressor and fuel-oil pump. Air and oil under pressure are thus delivered through piping and control valves to the burner.

The burner, located in the firing door of the heater, is the governing factor of the entire unit. This device consists of two distinct features: the nozzle and the pilot light with control.



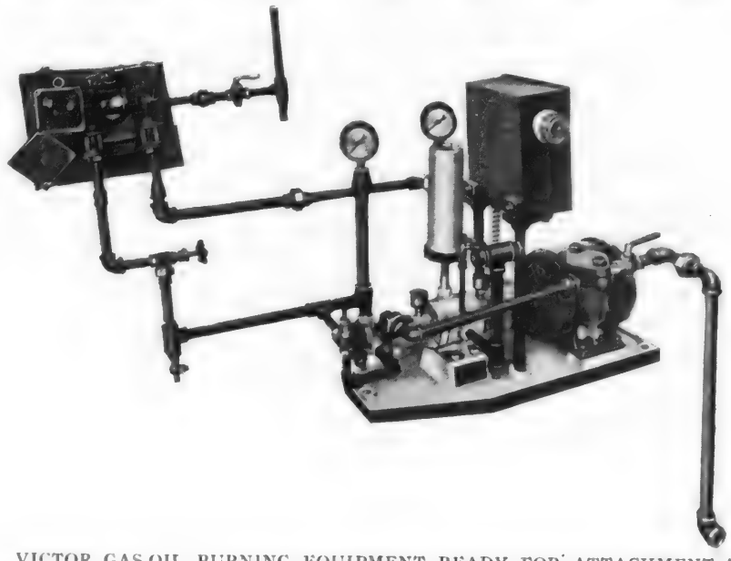
TYPICAL INSTALLATION OF VICTOR AUTOMATIC OIL BURNER IN HEATING BOILER.

The nozzle receives the air and oil under pressure and directs its discharge into the combustion chamber in the form of a finely-divided spray. This spray, when ignited, burns fiercely, at a high temperature, and, it is stated, without smoke. To ignite the oil spray there is provided a gas pilot light which is kept constantly burning, directly over the apex of the spray, near the nozzle tip. The pilot flame is integral with the Bunsen gas burner and pilot light control, the whole being designed to act as a safeguard against accidents, due to unburned gas or oil.

It will be noticed from the assembly of the nozzle and door casting that the nozzle, gas pilot light and pilot light control are all housed in the same casting. The nozzle is supported by two leads of pipe. The nozzle itself comprises an inner tube for fuel-oil and an outer tube for air. These tubes are screwed to the brass body. Leading from the body are two openings at right angles to the tubes which receive the air and oil pipes. On the right is the air and on the left, the oil lead.

Of course, it is necessary to control the volume of air discharged through the nozzle and this is regulated by the pressure which is indicated on a pressure gauge mounted on top of the air receiver. The volume is also affected by the orifice at the nozzle tip.

To modify this orifice the brass disc on the rearward end of the steel tube may be turned in either direction to increase or decrease the air blast as required. There is also provided a brass lock disc adjoining the brass valve body and this, of course, must be kept tight, except when making an adjustment.



VICTOR GAS-OIL BURNING EQUIPMENT READY FOR ATTACHMENT TO BOILER.

The orifice adjustment on the nozzle, it is pointed out, should be made when installed and in accord with the pressure. The latter should register on the pressure gauge about 1 or 2 lbs. for the average home heater, the diameter of the firebox governing this range.

Directly above the nozzle tip on the inside of the door casting is an opening through which the gas flame emerges for the ignition of the oil spray. The gas, as already explained, is fed to the flame by means of the Bunsen gas burner inserted in the door casting above the nozzle. At the base of the Bunsen tube, inside the cage, is the gas tip for regulating the size of the gas flame.

The pilot light control is suspended on a horizontal pipe to the left of the nozzle housing. The gas flame, if extinguished, allows the oil to pour into the heater unburned and flood the combustion chamber, except for the action of the pilot light control which shuts down the pumping unit until the gas flame is relighted.

FIRE BRICK BAFFLING

An important feature of this equipment is the baffling which is placed inside the combustion chamber. This is an assembly of fire brick arranged as illustrated in Fig. 3. The oil flame impinges itself against these bricks,

permitting the heat to be distributed uniformly upon the walls of the heater. With complete combustion, it is explained, the walls of the chamber are preserved without diminishing the area of heating surface.

Automatic control of the heating unit, as already indicated, is obtained by means of electric elements, interconnected. A room thermostat is provided to maintain uniform temperature in the room, while a boiler control is attached to the heater for regulating proper boiler conditions. There is also a control attached to the gas pilot light. These devices are electrically in control of the master switch in the relay box. This switch turns on or off the power, thus directly affecting the generation of heat in the combustion chamber.

Gas-oil is the fuel recommended by the manufacturers for use in with this burner. Gas-oil, as is well known, is a distillate of fuel-oil, and can be had at approximately the same price. In Chicago the market quotation recently was one cent more than for fuel-oil. Gas-oil, it is pointed out, is free from all foreign substances and requires no attention except to keep the auxiliary tank filled at proper intervals. Gas-oil is to be had in two grades, the dark or filtered oil, and the straw-colored oil. It is the latter which is free from foreign substances and which the manufacturers recommend to users of Victor oil burners.

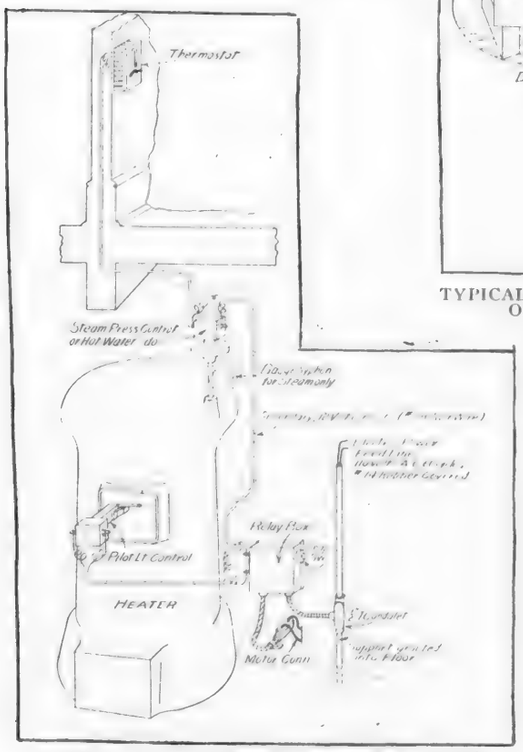


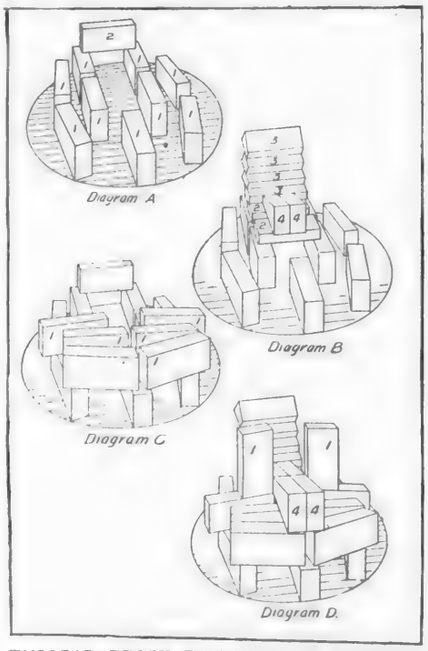
DIAGRAM OF ELECTRIC CONTROL SYSTEM FOR USE WITH VICTOR OIL BURNER.

It is possible, however, to burn fuel-oil of from 32° to 36° Baumé in the Victor oil burner, but not without annoyance to the user. When ordering fuel, it is stated, users should specify straw-color gas-oil 32°-36° Baumé.

Legal Decisions

Classification of Consumers for Rate-Making Purposes—Effect of Special Contracts.

The Pennsylvania Supreme Court holds, in an action against a lighting and a steam heating company to remove alleged discrimination in lighting and steam heating rates, Duquesne Light Co. v. Public Service Commission, 117 Atl. 63, that a statute which forbids rates which are



TYPICAL BRICK BAFFLING IN FIREBOX OF OIL-BURNING BOILERS.

"unjust or unreasonable or inadequate, or are unjustly discriminatory or unduly or unreasonably preferential," permits such classifications as do not offend against this provision; therefore a utility company supplying steam (in this case the Allegheny County Steam Heating Company) has the right to divide its customers into groups according to the purpose for which the steam is needed, these being subdivided into classes according to the quantity taken; each group and its subdivisions being set forth in a separate schedule, and the whole of the schedules forming the tariff filed with the Commission, and binding alike upon the company and its customers. When this is done, and the effective date of the tariff passes without objection being made, a presumption arises that these divisions and sub-divisions are equitable and just, and that the total probable revenue, which the utility will receive therunder, will not exceed that to which it is entitled. The company is entitled to rely upon this presumption in the first instance, on the hearing of any complaint filed with the Commission, after due notice to the utility to appear and defend; and after the passage of the effective date without objection, each consumer is entitled to rely, in the first instance, upon the presumption that the rate he is charged is just and reasonable, and will not be changed except as the result of a new tariff duly filed, or by the existing tariff being altered after he has been given an opportunity to be heard.

When a consumer demands a change in a schedule which would so reduce the company's revenues as to be confiscatory, the Commission should at once dismiss the complaint, or proceed to examine all the schedules of the company, after such notice to other customers as it deems requisite to furnish them an opportunity to be heard.

Contracts between a utility and a consumer which would compel the utility to give the consumer a preferential rate by putting him in a class by himself cannot be given effect to without defeating the Public Service Company Law.

Letter by Lessor to Lessee Held Waiver of Right to Terminate Lease for Failure to Install Heating Plant.

The Utah Supreme Court holds, Amussen Land or Securities Co. v. Cooperative Drug Co., 206 Pac. 704, that a letter by a lessor to a lessee, who had agreed to put a steam heating plant in the building leased, concerning the lessee's delay in installing a heating plant, stating: "This of course will leave unsettled the matter of damages for failure to install the same during the past winter," was a waiver by the lessor of his right to terminate the lease.

Commission's Jurisdiction of Claim for Alleged Overpayment for Steam.

The Pennsylvania Supreme Court holds, Beeten v. Carlisle Light, Heat & Power Co., 116 Atl. 676, that a company incorporated for the purpose of supplying "light, heat and power by means of electricity to the public" in a municipality is a public service corporation so far as furnishing live steam is concerned, where it holds itself out as willing to furnish live steam to the public, although it has no customers except one, with which it has a contract for five years; and where it files a tariff with the Public Service Commission, increasing the price of live steam over the contract price, the consumer's remedy is with the Commission in the first place, and the court of common pleas is without jurisdiction of a suit for reparation for money alleged to have been illegally collected pursuant to the filed tariff.

Portable Unit Ventilators

1—Univent Unit Heater.

In introducing the subject of unit ventilators, it seems fitting to mention the points that distinguish them as a class from unit heaters. In a broad sense, both are combined heating and ventilating devices and similar in general design but, as the names imply, the former are primarily ventilating devices, whereas the latter are primarily heating devices. This results in different fields of application that demand considerable difference in construction as regards detail.

The unit heater is designed for heating industrial buildings. The unit ventilator is designed for ventilating schools and similar buildings. The service is entirely different and necessitates considerable difference in design. A close analogy exists in the relation between a motor truck and a pleasure car. Both are automobiles but they are constructed differently for different services. In the former, strength and traction are paramount qualities, whereas in the latter, speed and comfort are given first consideration.

The service of the pleasure car demands many refinements not necessary in the truck. Likewise, the service of the unit ventilator demands refinements not necessary in unit heaters. Among the more important, are appearances, noiseless operation, sanitary provisions, compactness and accuracy in regulation.

The Univent unit heater owes its origin to Moses G. Hubbard, of New York; it is a development of the Monarch unit ventilator which was invented and placed on the market by Mr. Hubbard. As originally designed, one of these ventilators was intended to be placed in each room in front of a window. Fresh air was taken directly from the outside through the window and blown by the fan through the radiator and discharged into the room.

One of the difficulties experienced with this early type of unit ventilator was its lack of heating capacity. None of them, it was found had sufficient capacity to heat enough air for both heating and ventilating. Nor was any method provided for mixing the cold and warm air so as to give temperature control, either by hand or automatically. Generally the radiator was so crowded into the cabinet that there was insufficient space above and below the radiator. This prevented the proper mixing of the air and, consequently, the air passed through only a few sections and was not sufficiently heated. Finally, the apparatus was not fully accessible for cleaning or examination.

It was felt, however, that the Monarch ventilating system had many good features and later the patent rights were acquired by the Herman Nelson Corporation formerly Moline Heat, Moline, Ill. This company started in immediately to improve its design. After careful research in the company's laboratories, the problem of confining sufficient heating capacity in a reasonble space was solved by the design of the Univent double radiator. This radiator, it is stated, doubles the length of air travel over its surface, which increases the final air temperature and heating capacity. The double radiator also made the mixing damper possible without any reduction in space, thus permitting temperature control either by hand or automatically, without interfering with ventilating.

Patents covering these and other improvements have been granted to Wilfred Shurtleff, of Moline, Ill., the inventor of the well-known Moline Heat system of steam circulation and many other heating devices.

Fresh air is drawn into the upper compartment of the Univent through a window or opening in the wall. In this upper compartment is provided a small electric motor, which operates two centrifugal fans. The blast created by these fans force the fresh outdoor air down through the tempering half of the radiator, over the dust-eliminating device shown in the bottom comparment,

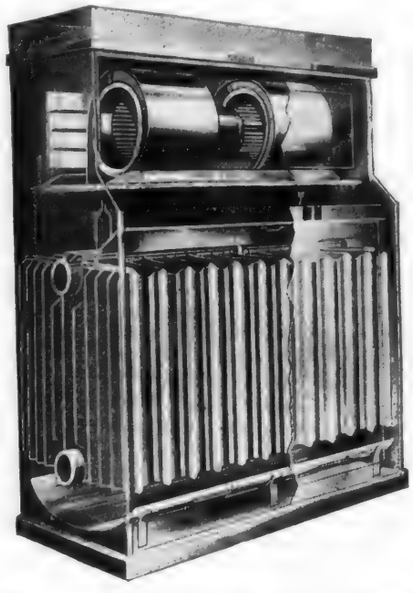


FIG. 1.—CONSTRUCTION OF UNIVENT UNIT VENTILATOR.

then up through the heating side of the radiator and out through the front of the Univent towards the ceiling. The fresh warm air leaves the machine almost vertically at a velocity of approximately 1000 ft. per minute, depending upon conditions.

The discharge outlet is of the nozzle form to secure a high velocity air charge jet necessary for the proper diffusion of the air in the room wthout drafts and a complete mixture of the warm and tempered air. No screen is used in the outlet which is free from obstruction.

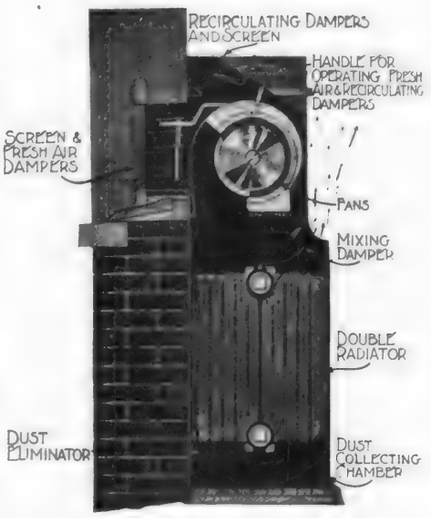


FIG. 2.—COURSE OF AIR FLOW IN UNIVENT UNIT VENTILATOR.

As the fresh air strikes the ceiling it is deflected and diffused through the room. This action, it is maintained, serves to break up all air pockets and permits the air to reach every nook and corner.

The air then leaves the room through a vent register or flue, which is generally placed near the floor on the opposite side of the room, depending upon certain local conditions. It passes to the outside of the building either directly through the flue or through a corridor or attic.

As shown in Fig. 2, a mixing damper is provided above the radiator for mixing the cold and warm air as it leaves the Univent, making it convenient to control the temperature of the air either by hand or automatically. The ventilator is also arranged so that either fresh air can be taken from out-of-doors, or the air in the room can be recirculated. When the circulating damper is closed, the fresh air damper is open, and vice versa.

In order to secure noiseless operation, care has been taken to have the motors placed in running balance before and after assembling. All the blades of the Univent fan are stamped from a single sheet of copper, aluminum or other non-corroding metal. They are then formed around a pair of rims to which they are brazed. The whole fan, including blades and rims, it will be seen, is thus made in practically one piece.

Another step taken to eliminate the noise of the running motor is the arrangement to support the mechanical parts in a way that keeps them from contact with the steel cabinet. The suspension plate to which the Univent motor and fans are attached is independently suspended on the radiator. This is considered one of the important features applying to Univent construction as conducing to noiseless operation and was patented by M. G. Hubbard, of New York.

In the matter of diffusion the fact that the fresh heated air leaves the Univent at an angle of not over 30°

from the vertical and that it is impossible to discharge the air horizontally is considered an important point in its successful operation.

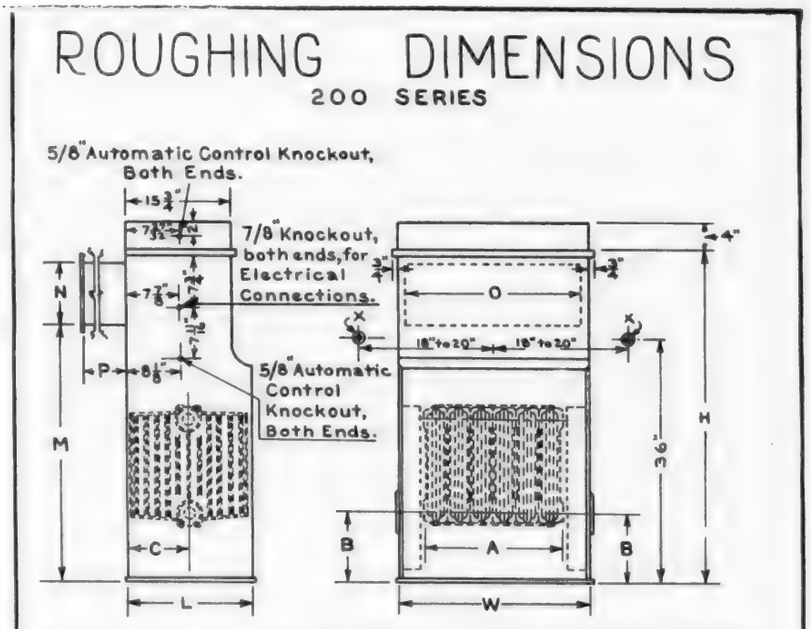
With this method of distribution the location of the vent outlets from the room becomes of special importance. Under average conditions, it is found, one outlet is sufficient, but there are sometimes conditions that make it advisable to provide several outlets in different parts of the room. Vent outlets that are too large, it is pointed out, will sometimes interfere with good diffusion. If the vent outlets are so large that the air is taken from the room as quickly as it is admitted, perfect diffusion cannot be obtained and the air is likely to be short-circuited. Vent outlets, it is argued, should not be equipped with heat coils or provided with other means for extracting the air.

The entire front of the cabinet may be quickly opened for inspection and cleaning. A single large door with lock and hinge at bottom, gives access to the fan compartment and permits of a removal of the complete fan and motor assembly. A single large sliding door, with handles, gives access to the entire lower compartment.

Air temperature is controlled in the Univent by means of a mixing damper arranged to by-pass air from the upper plenum chamber to the cabinet outlet. The arrangement is such that the cold outside air is driven down into the back half of the radiator and tempered before being by-passed. It is claimed that this insures a more uniform mixture of air and prevents cold drafts which are inevitable in cold weather where attempts are made to mix heated air and untempered cold air.

The Univent mixing damper, it is claimed, gives temperature control without drafts in cold weather, and a combined control of the mixing damper and radiator gives control in mild weather.

These units are regularly fitted with


ROUGHING DIMENSIONS
200 SERIES
5/8" Automatic Control Knockout, Both Ends.
7/8" Knockout, both ends, for Electrical Connections.
5/8" Automatic Control Knockout, Both Ends.
X = Electrical Outlet, to be provided at one side of machine, left side preferred.
Dimension A is over-all length of radiator.
Dimension B is distance from bottom of Cabinet to center of radiator tappings.

SERIES	RADIATOR					CABINET			INTAKE			
	A	B	C	Steam	Return	H	W	L	M	N	O	P
201	20¼"	14"	9⅛"	1¼"	3/4"	49⅛"	28⅛"	18½"	37⅛"	9⅛"	26⅛"	Intake
202	20¾"	"	"	"	"	"	"	"	"	"	"	furnished
203	21¼"	"	"	"	"	"	"	"	"	"	"	12" long at
204	20¼"	11¾"	"	"	"	"	"	"	"	"	"	P. Can be
205	20¾"	"	"	"	"	"	"	"	"	"	"	Cut to
206	21¼"	"	"	"	"	"	"	"	"	"	"	not less
207	20¼"	9⅛"	"	"	"	"	"	"	"	"	"	than 6"
208	20¾"	"	"	"	"	"	"	"	"	"	"	long on
209	21¼"	"	"	"	"	"	"	"	"	"	"	job.
210	20¼"	14"	"	"	"	"	"	"	"	"	"	
211	20¾"	"	"	"	"	"	"	"	"	"	"	
212	21⅛"	"	"	"	"	"	"	"	"	"	"	
213	20¼"	11¾"	"	"	"	"	"	"	"	"	"	
214	20¾"	"	"	"	"	"	"	"	"	"	"	
215	21¼"	"	"	"	"	"	"	"	"	"	"	
216	20¼"	9⅛"	"	"	"	"	"	"	"	"	"	
217	20¾"	"	"	"	"	"	"	"	"	"	"	
218	21¼"	"	"	"	"	"	"	"	"	"	"	
219	20¼"	14"	"	"	"	"	"	"	"	"	"	
220	20¾"	"	"	"	"	"	"	"	"	"	"	
221	21¼"	"	"	"	"	"	"	"	"	"	"	
222	20¼"	11⅜"	"	"	"	"	"	"	"	"	"	
223	20¾"	"	"	"	"	"	"	"	"	"	"	
224	21¼"	"	"	"	"	"	"	"	"	"	"	
225	20¼"	9⅛"	"	"	"	"	"	"	"	"	"	
226	20¾"	"	"	"	"	"	"	"	"	"	"	
227	21¼"	"	"	"	"	"	"	"	"	"	"	

A.H.W.

FIG. 6.—ROUGHING DIMENSIONS FOR UNIVENT UNIT VENTILATOR, 200 SERIES.

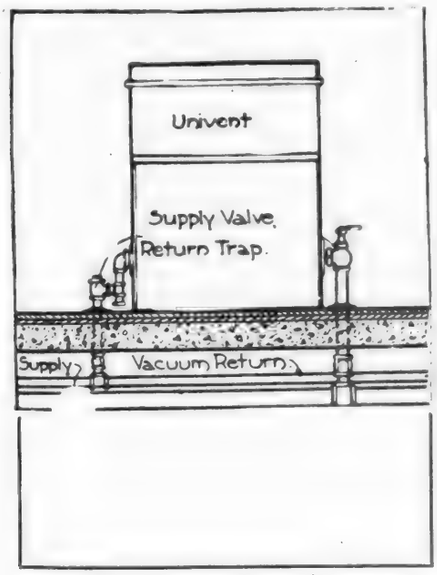


FIG. 3.—TYPICAL CONNECTIONS OF UNIVENT TO VACUUM SYSTEM.

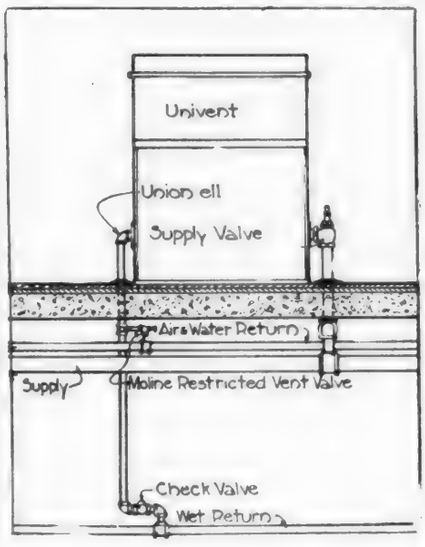


FIG. 4.—TYPICAL CONNECTIONS WITH MOLINE HEAT.

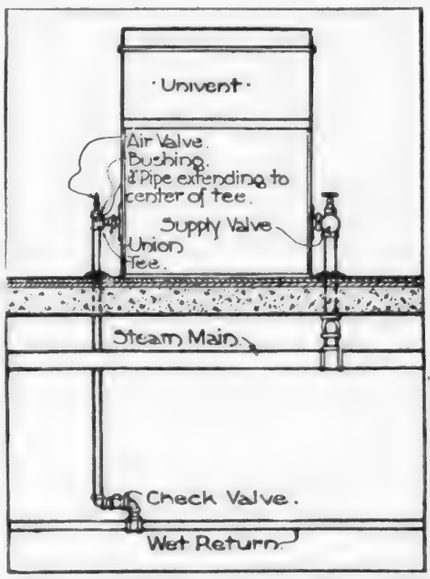


FIG. 5.—TYPICAL CONNECTIONS TO ORDINARY STEAM SYSTEM.

a dust eliminator and, if desired, a vapor humidifier can be added. This humidifier consists of a small pipe perforated its entire length with small holes. It is placed in the cabinet above the radiator and connected with the steam supply pipe. Vapor is admitted to the heater through this pipe and discharged with the air supply to the room. Either a hand valve can be placed on the pipe connection to admit as much or as little vapor as required for proper humidity or where automatic control is required, it can be connected with a humidostat placed on the wall of the room and operated by a compressed air system, such as that used for temperature control.

The reservoir at the bottom of the cabinet acts as a dust-collecting chamber. It can be kept filled with water or glycerine to accomplish this purpose.

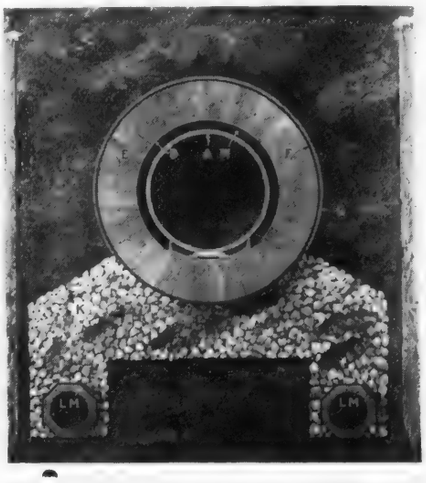
New Trade Publications

WEATHER VEIN for October, 1922, the monthly periodical of the Carrier Engineering Corporation, Newark, N. J., might well be called the candy number as it features the development of candy and confection manufacture, supplemented by an account of the application of "manufactured weather" to such plants as those of the Robt. A. Johnston Co., Milwaukee, Wis. and of Belle Mead Sweets, Trenton, N. J. The announcement is made that on account of the need of preparing additional engineering data on "manufactured weather." The Weather Vein will suspend publication during November and December. Regular publication, it is added, will be resumed in January, 1923.

UTICA-IMPERIAL SUPER-SMOKELESS BOILERS, with special reference to their use in churches and religious institutions, has been issued by the Utica Heater Co., Utica, N. Y. as the fifth of the series devoted, respectively, to schools; apartments, hotels and residences; theatres; public buildings; churches; and offices, industrial buildings and garages. The series will comprise seven bulletins in all, the last one to be largely technical, containing measurements, ratings and other technical information. In the bulletin featuring churches, the illustrations of buildings in which Utica-Imperial Super-Smokeless boilers are installed include the First Congregational Church, at Wauwatosa, Milwaukee, Wis.; the Fourteenth Church of Christ Scientist, Chicago; St. John's Church, Chicago; St. Peter's Church, Pittsburgh; All Saints (R. C.) Church, Brooklyn; B'Nai David Ohave Zedek Synagogue, Chicago; and Beth Hamedrosh Hagodoi Synagogue, Denver. Other important buildings illustrated, which are equipped with two or more of these boilers, are Visitation Convent, St. Louis; Salvation Army Building, Waukegan, Ill.; and Orthodox Old Folks' Home, Cleveland. Some 116 additional installations are listed in the catalogue. Size 8½ x 11 in. Pp. 12.

DAYTON-DOWD CENTRIFUGAL PUMPS, embracing a line adapted to practically all classes of pumping service, are presented in a comprehensive manner in a new catalogue issued by the Dayton-Dowd Co., Quincy, Ill. As the company states, the progress made in the design and application of centrifugal pumps during the past few years has been a notable engineering achievement. Designs and patterns that were in use only a few short years ago are now more or less obselete, so fast has this development taken place. On this account alone, the new catalogue will be welcomed by the trade and will be found unusually complete and useful. Size 7½ x 10½ in. Pp. 32 (punched for binding.)

UNDERGROUND PIPE CONSTRUCTION FOR STEAM DISTRIBUTION, as applied to central station heating for cities, communities, industrial plants, institutions and municipal buildings, is the title of a bulletin (No. 161) which will be welcomed by engineers and contractors planning the construction of underground steam mains, and who require detailed specifications with which they may outline the actual lengths and sizes of the proposed mains, so that this information may be handed to those figuring the contract and all bidders thus placed in a position to quote on the same standard type of construction. The opening pages of the bulletin, which is published by the American District Steam Co., North Tonawanda, N. Y. show the latest form of the Adsco "Standard Construction" of casing, with



CROSS SECTION OF ADSCO CASING CONSTRUCTION FOR UNDERGROUND HEATING MAINS.

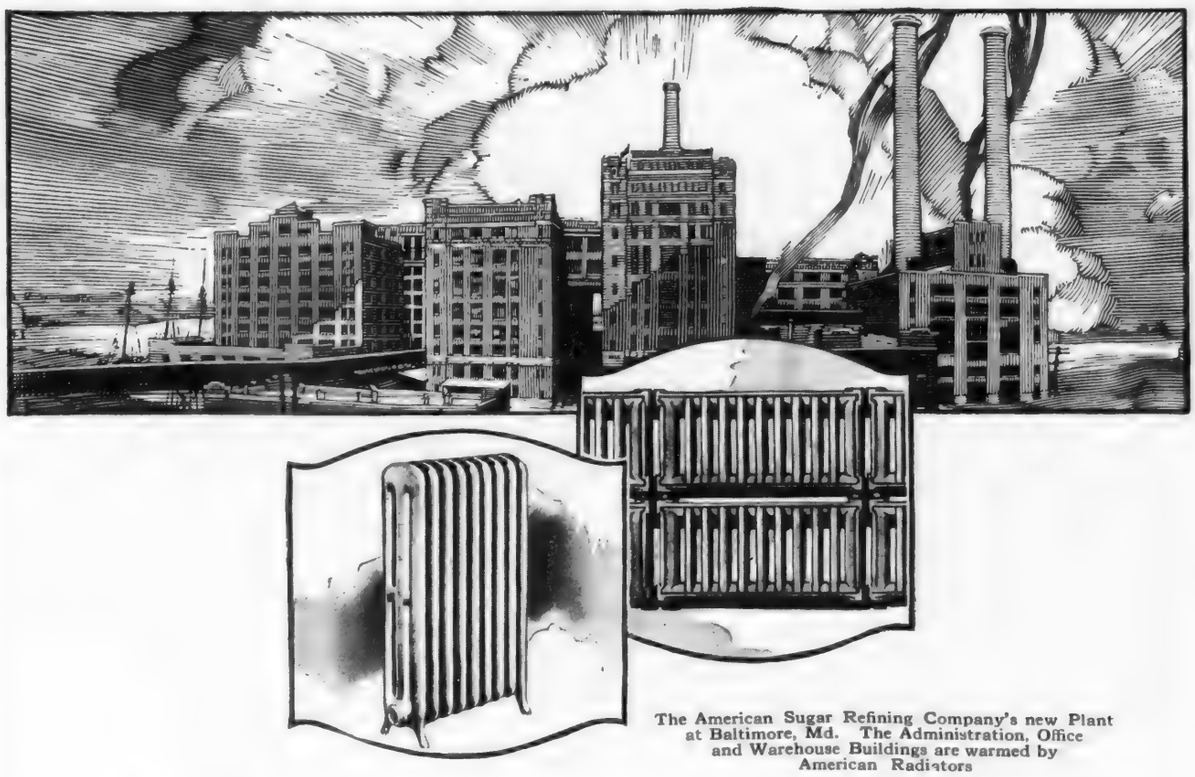
underdrainage, and other illustrations show in detail the materials and devices used. An efficiency table is included, the three concluding pages being devoted to "Specifications for Underground Mains—Casing Construction." Size 8½ x 11 in. Pp. 12.

ABCO BOILERS, both of the round and square types, embracing the full line of the Advance Boiler Corporation, Grand Central Terminal, New York are shown with the necessary data for the use of the engineer and contractor, in a catalogue issued by the company. The frontispiece illustrates the company's plant in Poughkeepsie, N. Y., where, it is stated, the most up-to-date and modern equipment has been installed for the exclusive manufacture of cast-iron boilers. Abco boilers for both steam and water, it is pointed out, are designed to burn either anthracite or bituminous coal. Illustrations and details are presented of the various types, special reference being made to the method of providing for air admission for initial combustion through the base openings on each side of the boiler. Other points taken up are coal-carrying capacity and rate of combustion, grate area, heating surface, gas travel, distribution of heat, short-circuit prevention, water circulation and steam space. The smokeless feature of the company's smokeless types is also emphasized, being an exclusive design with Abco boilers,. This feature is a part of the boiler and not a device placed in an ordinary boiler. The air tubes used are inserted in each section in three parts and are supported by and are a part of the fire-brick arch. These combined fire-brick arches form a continuous series of tubes from the rear to the front of the boiler and serve to distribute free oxygen which is preheated before entering the boiler by the smoke box to a temperature of about 300° F. This air is distributed at each section before the temperature of the gases from the fire-bed have touched any of the cooling surfaces of the boiler. Full data are given in the catalogue on three different series of square boilers for steam and water and for two types of round boilers. The catalogue concludes with several pages of general engineering information. Size 4 x 7 in. Pp. 44.

UNIBLADE BLOWERS, pulley-driven, and motor-driven, are the subjects of new bulletins, Nos. 57 and 58, just published by the Autovent Fan & Blower Co., 730-738 West Monroe St., Chicago, Ill. The bulletins are well compiled and contain very full information on these two types of blowers.

CARLING TURBINE SUPERVANE BLOWER, described as newly-patented and comprising the latest development of individual forced draft unit, is described in Bulletin No. 50, just received from the Carling Turbine Blower Co., Worcester, Mass. The feature of the new type is that the blades overlap at the hub and are concave in shape. They are of peculiar shape and deliver the air parallel to the axis without the use of guide vanes or extended fan housing. Size 8½ x 11 in. Pp. 32.

B. T. MCGIVERN, a well-known sales representative with the Davis Supply Co., Chicago, Ill., died at his home in Winnetka, Ill. He had been connected with the Davis company for the past fourteen years and previous to that represented the Holland Radiator Company.



The American Sugar Refining Company's new Plant at Baltimore, Md. The Administration, Office and Warehouse Buildings are warmed by American Radiators

Another new chapter in an old story

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Direct Rad		Equiv. indirect 40° Reg. vents 4"ϕ			Flue area in sq. inches			Register Area
Stone or Concrete Walls	Brick Walls	Weight of air lbs. per hr. Bar. 29.92 Temp. 115°-70° = 0.120	Total No. Sections	Ind. Rad. 1 Section deep 4" Centres	1st. Floor V=180 f/m	2nd. Floor V=300 f/m.	Vel. of 240 f/m.	Gr. area of 100 f/m Throw. free area.
14	15	304	2	21.50	60	36	48	100
21	22	455	3	32.25	90	54	72	150
27	29	606	4	43	120	72	96	200
34	36	757	5	53.75	150	90	120	250
40	43	908	6	64.50	180	108	144	300
47	50	1059	7	75.25	210	126	168	350
53	57	1210	8	86	240	144	192	400
60	64	1361	9	96.75	270	162	177	450
66	71	1512	10	107.50	300	180	240	500
73	78	1663	11	118.25	330	198	264	550
80	86	1814	12	129.00	360	216	288	600
86	92	1965	13	139.75	390	234	312	650
93	99	2116	14	150.50	420	252	346	700
99	106	2267	15	161.25	450	270	360	750
105	113	2418	16	172	480	284	384	800
112	120	2569	17	182.75	510	302	408	850
119	127	2720	18	193.50	540	320	432	900
125	134	2871	19	204.25	570	338	456	950
132	141	3022	20	215	600	396	480	1000
138	148	3173	21	226.75	630	374	508	1050
145	155	3324	22	236.50	660	392	528	1100
151	162	3475	23	247.25	690	410	554	1150
158	169	3625	24	258	720	428	576	1200
164	176	3777	25	268.75	750	446	600	1250
171	183	3928	26	279.50	780	464	623	1300
177	190	4079	27	290.25	810	482	650	1350
184	197	4230	28	301	840	500	672	1400
190	204	4381	29	311.75	870	518	646	1450
197	211	4532	30	322.50	900	536	720	1500
204	218	4683	31	333.25	930	554	744	1550
211	225	4834	32	344	960	572	768	1600
218	232	4985	33	354.75	990	590	792	1650
225	239	5136	34	365.5	1020	608	816	1700
232	246	5287	35	376.25	1050	626	840	1750
239	253	5438	36	387.00	1080	644	864	1800
246	260	5589	37	397.75	1110	660	888	1850
251	267	5740	38	408.50	1140	680	912	1900
258	274	5891	39	419.25	1170	698	934	1950
266	281	6042	40	430.	1200	716	960	2000
272	288	6143	41	441.75	1230	734	984	2050

P.A.C.

RADIATION COMPUTING—Indirect Steam Heating No. 13-CC

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For converting direct radiation to indirect. Flue sizes. etc.

Direct Rad.		Equiv. indirect 40" Reg. vent 0 4"ϕ			Flues-area in sq. in.			Reg. Gr. area
Stone or Concrete walls	Brick walls	Weight of air lbs. in 1hr. For 65° Temp. 15-30° 0-120	Total No Sections	Ind. Rad. 2-Sections deep 4" centres	1st. Floor V: 180 f/m.	2nd. Floor V: 300 f/m	Vel. of 240 f/m.	Gr. area of 180 f/m Thru' face area.
26	28	348	4	43	67	40	54	110
39	42	522	6	64.5	100	60	84	165
52	56	696	8	86	135	80	108	220
65	70	870	10	107.5	168	100	134	275
78	84	1044	12	129	201	120	165	330
91	98	1218	14	150.5	234	140	187	385
104	112	1392	16	172	267	160	214	440
117	126	1566	18	193.5	300	180	240	495
130	140	1740	20	215	333	200	267	550
143	154	1914	22	236.5	366	220	293	605
156	168	2088	24	258	399	240	320	660
169	182	2262	26	279.5	432	260	346	715
182	196	2436	28	301	465	280	373	770
195	210	2610	30	322.5	498	300	399	825
208	224	2784	32	344	531	320	426	880
221	238	2958	34	365.5	564	340	452	935
234	252	3132	36	387	597	360	479	990
247	266	3306	38	408.5	630	380	505	1045
260	280	3480	40	430	663	400	532	1100
273	294	3654	42	451.5	696	420	558	1155
286	308	3828	44	473	729	440	585	1210
299	322	4002	46	494.5	762	460	611	1265
312	336	4176	48	516	795	480	637	1320
325	350	4350	50	537.5	828	500	664	1375
338	364	4524	52	559	861	520	691	1430
351	378	4698	54	580.5	894	540	637	1485
364	392	4862	56	602	937	560	749	1540
377	406	5036	58	623.5	970	580	775	1596
390	420	5210	60	645	1003	600	802	1650
403	434	5384	62	666.5	1036	620	828	1705
416	448	5554	64	688	1069	640	855	1760
429	462	5724	66	709.5	1102	660	881	1815
432	476	5894	68	730	1135	680	908	1870
445	490	6064	70	751.5	1168	700	934	1925
458	504	6234	72	773	1201	720	962	1980
471	518	6404	74	794.5	1234	740	987	2035
484	532	6574	76	816	1267	760	1014	2090
487	546	6744	78	837.5	1300	780	1040	2145
500	557	6914	80	859	1333	800	1067	2200
513	573	7084	82	881.5	1366	820	1093	2255

P.A.C.

RADIATION COMPUTING—Indirect Water Heating | No. 13-DD

Copies of this Data Sheet, printed separately, 5 cents each.

THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

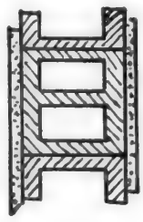
RADIATION COMPUTING.

Heating-Steam-Partitions.

Radiation to compensate for Heat Losses through various partitions. Temp. dif. 30°

Area in Sq. ft.	Direct steam Radiation				
	A-A1	B-B1	C	D-D1	
60	4	3	2	2	
80	5	4	3	2	
100	6	4	4	3	
120	7	5	4	3	
140	8	6	5	4	
160	10	7	6	4	
180	11	8	7	5	
200	12	9	7	5	
220	13	10	8	6	
240	14	11	9	6	
260	16	12	10	7	
280	17	13	11	7	

Wood



Hollow tile

A = Plaster-1-side C = Plaster-2-sides
B = " -2- "
B1 = 8" Brick Plastered
D1 = Expanded metal, plaster 2 sides, asbestos fill.
A2 = " " " 2 " air space
D = Double hollow tile air space and plaster both sides.

RADIATION COMPUTING—Steam Heating, Partitions | No. 13-EE

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THE HEATING AND VENTILATING MAGAZINE—1123 BROADWAY, N. Y. CITY

RADIATION COMPUTING.

Heating-Hot Water-Partitions

Radiation to compensate for Heat losses through various partitions. Temp. dif. 30°

Area in Sq. Ft.	Direct Hot Water Radiation				
	A-A1	B-B1	C	D-D1	
60	6	4	4	3	
80	8	6	5	3	
100	10	7	6	4	
120	12	9	7	5	
140	14	10	8	6	
160	16	12	10	7	
180	18	13	12	8	
200	20	15	13	9	
220	22	16	14	10	
240	24	18	15	11	
260	26	19	17	12	
280	28	21	18	13	

Wood and Hollow tile partitions

A- Plaster 1 Side for wood

B- do 2 do do do

C - do 2 do do Hollow tile

B1 - 8" Brick Plaster 2 Sides

D1 - Expanded metal, plaster 2 sides, asbestos Fill,

A1 - Expanded metal plaster 2 sides air space

D Double hollow tile, air space and plaster both sides

RADIATION COMPUTING—Water Heating, Partitions | No. 13-FF

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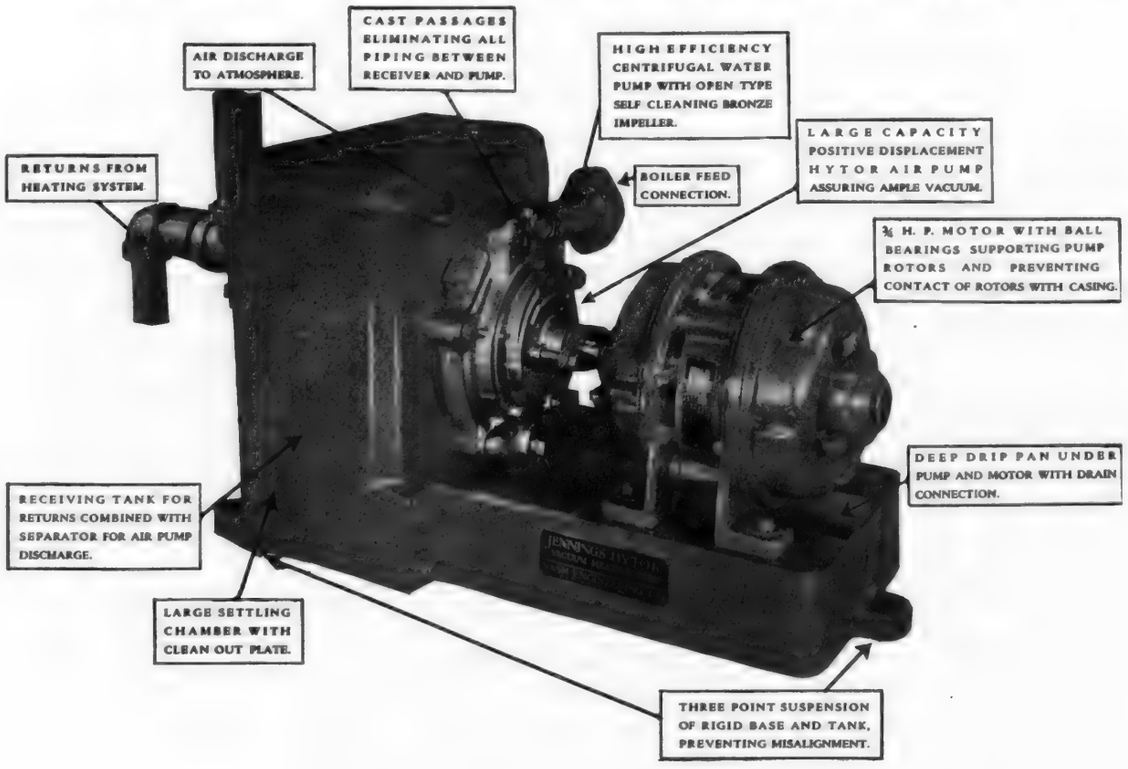
THE COAL SITUATION
DEMANDS EFFICIENT HEATING

EFFICIENT HEATING DEMANDS
THE JENNINGS PUMP


CAST PASSAGES ELIMINATING ALL PIPING BETWEEN RECEIVER AND PUMP.
AIR DISCHARGE TO ATMOSPHERE.
HIGH EFFICIENCY CENTRIFUGAL WATER PUMP WITH OPEN TYPE SELF CLEANING BRONZE IMPELLER.
LARGE CAPACITY POSITIVE DISPLACEMENT HYTOR AIR PUMP ASSURING AMPLE VACUUM.
RETURNS FROM HEATING SYSTEM.
BOILER FEED CONNECTION.
¾ H. P. MOTOR WITH BALL BEARINGS SUPPORTING PUMP ROTORS AND PREVENTING CONTACT OF ROTORS WITH CASING.
DEEP DRIP PAN UNDER PUMP AND MOTOR WITH DRAIN CONNECTION.
RECEIVING TANK FOR RETURNS COMBINED WITH SEPARATOR FOR AIR PUMP DISCHARGE.
LARGE SETTLING CHAMBER WITH CLEAN OUT PLATE.
THREE POINT SUSPENSION OF RIGID BASE AND TANK, PREVENTING MISALIGNMENT.

Now is the time to prepare your heating facilities to meet the conditions of the coming winter.

The installation of a Jennings Return Line Pump in connection with your system means quick heat in the morning, at the most isolated radiators, and in zero weather. It means a positive control of heat at all times and the elimination of radiator noises. It means an economy in feul, that, according to our customers, makes this piece of equipment a real dividend paying proposition.

Jennings Pumps are made for any size installation. The small unit here illustrated has ample capacity of 5,000 sq. ft. of equivalent direct radiation. Because of simplified design, in connection with quantity production, this outfit is being sold at a price never before possible in a pump of this capacity.

The pump incorporates all of the high grade workmanship and material characteristic of our Jennings equipment. It is equipped with solid bronze air rotor, rotor housing, water impeller and shaft.

In this unit all piping complications have been removed, and it is only necessary to make three connections:

1. The Return Main.
2. The Water Discharge.
3. The Air Discharge.

While the new compact "M" type is furnished in one size, our well known Jennings Pumps in separate tank design, as recommended for larger capacities, are furnished for any size installation.

Many thousands of these pumps have been installed and have given universal satisfaction.

NASH ENGINEERING CO., South Norwalk, Conn., U. S. A.
Please send graphic device and bulletins covering
[ ] Hytor Air Compressors [ ] Return Line Heating Pumps
[ ] Hytor Vacuum Pumps [ ] Boiler Feed Pumps
Name.....
Company.....
Position.....
Doc.....

NASH ENGINEERING CO.
SO. NORWALK CONN., U. S. A.

Trade and Miscellaneous Notes

Coming Events.

January 23-26, 1923.—Annual meeting of the American Society of Heating and Ventilating Engineers, in Washington, D. C. Headquarters at the Hotel Washington, just completed. Secretary, C. W. Obert, 29 West 39th Street, New York.

April 18-19, 1923.—Annual meeting of the National Metal Trades Association in New York. Headquarters at the Hotel Astor.

Miscellaneous Notes.

October Business Conditions, according to figures compiled by the Department of Commerce in its "Survey of Current Business," was the large increase in production in the basic commodities. Production of both bituminous and anthracite coal showed further increases, but the transportation situation was still a limiting factor, not only for coal, but for steel, building materials and other products for which the demand has increased.

Portland, Ore.—The Robinson apartment house, recently completed at East 23rd and Madison Streets, Portland, is the first apartment house in that city to be heated by electricity The heaters were installed in each apartment by the Portland Railway, Light & Power Company. An auxiliary furnace in the basement heats the hallways and supplies the building with hot water. The apartment house is a two-story structure with exterior walls of stone tone stucco. It is 46 ft. x 76 ft. in size and contains ten two-room and two three-room apartments.

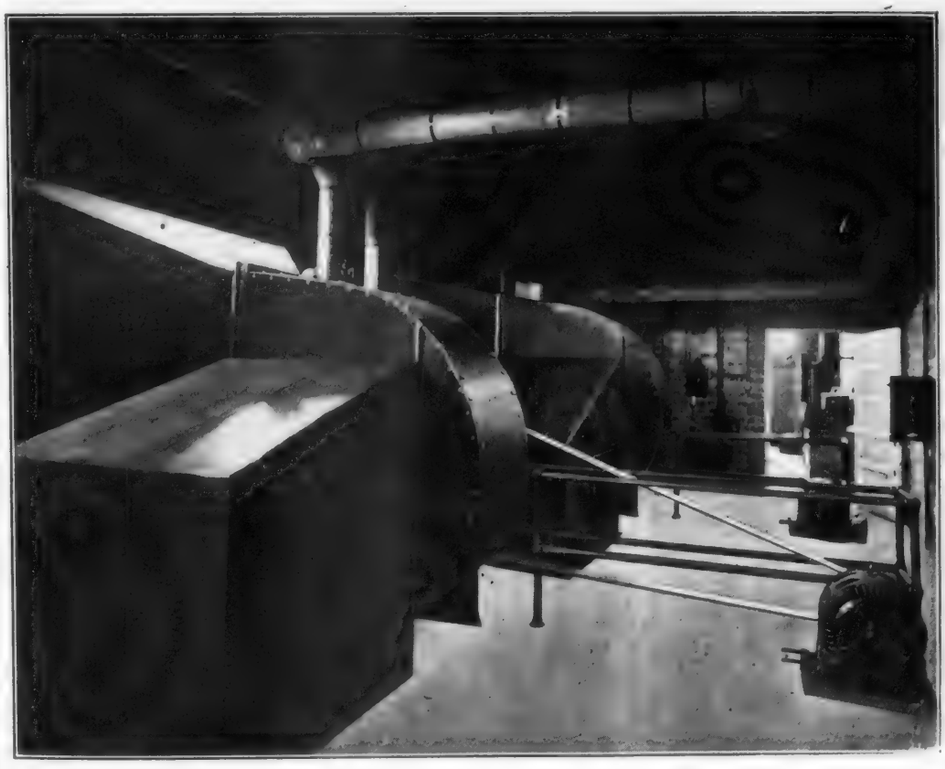
London, Eng.—Further particulars of the heating and ventilation of the new County Hall, formally opened in London last July as the new home of the London County Council, are to the effect that the equipment for supplying warm, filtered air to the council chamber is also arranged for supplying cool air through the use of ice. Air-supply pipes lead through the chamber floor to every one of the 200 members' seats. At each seat is a desk at the back of which is an outlet register pointing upward and another register below the desk pointing horizontally in such a manner that air issuing from it strikes the occupant of the seat like a breeze from a fan. On the horizontal register is a sliding button which controls a valve in such a way that the occupant of the seat can switch the air either to the vertical register which directs it upward or to the horizontal register which directs the air to himself without affecting his neighbor. Additional fans remove the vitiated air from the floor level and from the roof of the chamber.

Good Health Week received a fine boost from Health Commissioner William H. Peters of Cincinnati, O., who was the author of a prominently-displayed article on the campaign in The Cincinnati *Post* for October 20.

Cleveland, O.—Superintendent of Schools R. G. Jones has issued an order that one hour after the opening of school morning and afternoon, the classroom windows shall be thrown open for a period of three minutes.

Illinois Association of Real Estate Dealers, which held its annual convention in Decatur, Ill., recently, were the guests of the H. Mueller Mfg. Company for one day. While the men were inspecting the Mueller plant, the ladies were entertained at the company's country place, Mueller Lodge.

Universal Exposition of Inventions and Patents will be held at the Grand Central Palace, New York, February 17-22, 1923. Each day during the exposition the work of one of the world's



BELDON HIGH SCHOOL, CANTON, OHIO

THAYER & JOHNSON, Architect 2 No. 10 Uniblade Blowers Wm. M. Kingsbury, Engineer

REGISTERED AUTOVENT. TRADE MARK

Where uniform dependable air circulation is required you will find a Uniblade Blower in operation.

Bulletins No. 57 and 58 fully describing these blowers will be sent upon request to contractors engineers and architects.

Autovent Fan & Blower Company

730-738 W. MONROE STREET
CHICAGO, ILLINOIS

Branch Offices:—Principal Cities

great inventors or scientists will be featured. Inventors generally will be given the opportunity of displaying their ideas.

Chamber of Commerce of the United States has asked the Coal Commission to be given an opportunity to present the views of organized business and industry in the event that the Coal Commission, during its investigation, seriously considers any proposal looking to the nationalization of the coal industry.

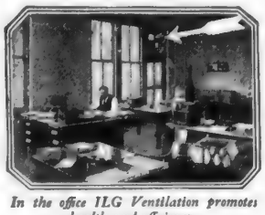
October Construction is 14% ahead of last year, according to the F. W. Dodge Company's review of building activity during October, 1922. Building contracts awarded during October in the 27 northeastern States amounted to $253,137,000. The progress of the seasonal decline in October is shown in the drop of 7% from the previous month. In view of the fuel and car shortage and other restrictive factors, construction activity continued at a very satisfactory rate. Residential construction continued at a high rate, the October figures of $110,776,200 being 44% of the month's total. Other important items in the October figures were: $41,477,000, or 16%, for public works and utilities; $32,037,000, or 13%, for business buildings; $27,640,000, or 11% for industrial buildings; and $17,437,000, or 7% for educational buildings. In New England there was a decline of 13% from September, but an increase of 22% over October of last year. In New York State and northern New Jersey the figures showed an increase of 3% over September and a decrease of 14% from October, 1921; the increase over September, however, was outside of New York City, which showed a decline. In the Middle Atlantic States, there was a decline of 21% from the previous month and of 6% from October, 1921. The Pittsburgh district made the best comparative showing with an increase of 14% over the preceding month and of 61% over the corresponding month of last year. The Central West also made a good showing with a decline of 15% from September, but with an increase of 42% over the October 1921 figures. In the Northwest, a decrease of 42% from September was reported and 58% from October, 1921.

Indiana Foundrymen held an important conference at Purdue University, November 23-24, under the direction of the Department of Practical Mechanics of the University. One of the sessions was presided over by Professor J. D.

The Air You Breathe Should be As Pure as the Water You Drink

Wherever you live, shop, work or dine, attend church or theatre, you are wisely cautioned to look for good ventilation as you would for a fire escape

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY



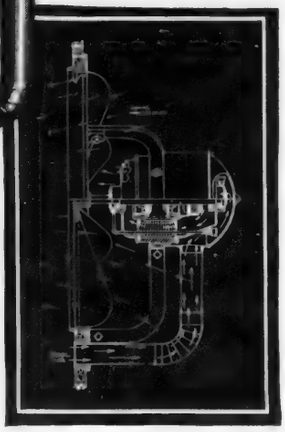
In the office ILG Ventilation promotes health and efficiency.

Shopping is a pleasure in the store that has ILG Ventilation.

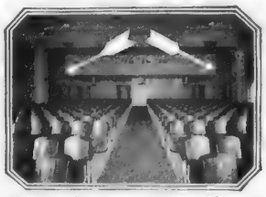
An ILG Fan in the restaurant banishes cooking odors and oppressing heat.

ILG Ventilation in public garages is a safety-first measure.

Self Cooled Motor Fans are safeguarding your health in thousands of stores, offices, halls, theatres, restaurants, etc., everywhere.

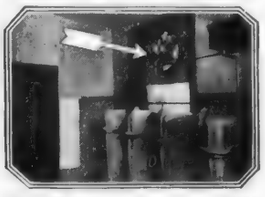


A sectional view of the *Ilg Self-Cooled Motor Propeller Fan,* illustrating the patented method of ventilating the motor by the vacuum created at the axis of the fan, drawing a current of air from the outside through the tube or vent pipe connecting with the hood which completely encloses the motor on all sides but the front. The vent pipe serves as an intake for the air, guides it to the heart of the motor where it is carried away with the general exhaust. This all-important feature is broadly protected by basic patents.

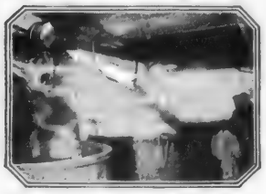


ILG Ventilation is a guardian of human welfare in public buildings.

Foul air does not contaminate food products where there is ILG Ventilation.



ILG Ventilation promotes good health sanitation and personal hygiene.



Industrial plants recognize ILG Ventilation as the life force of man-power.

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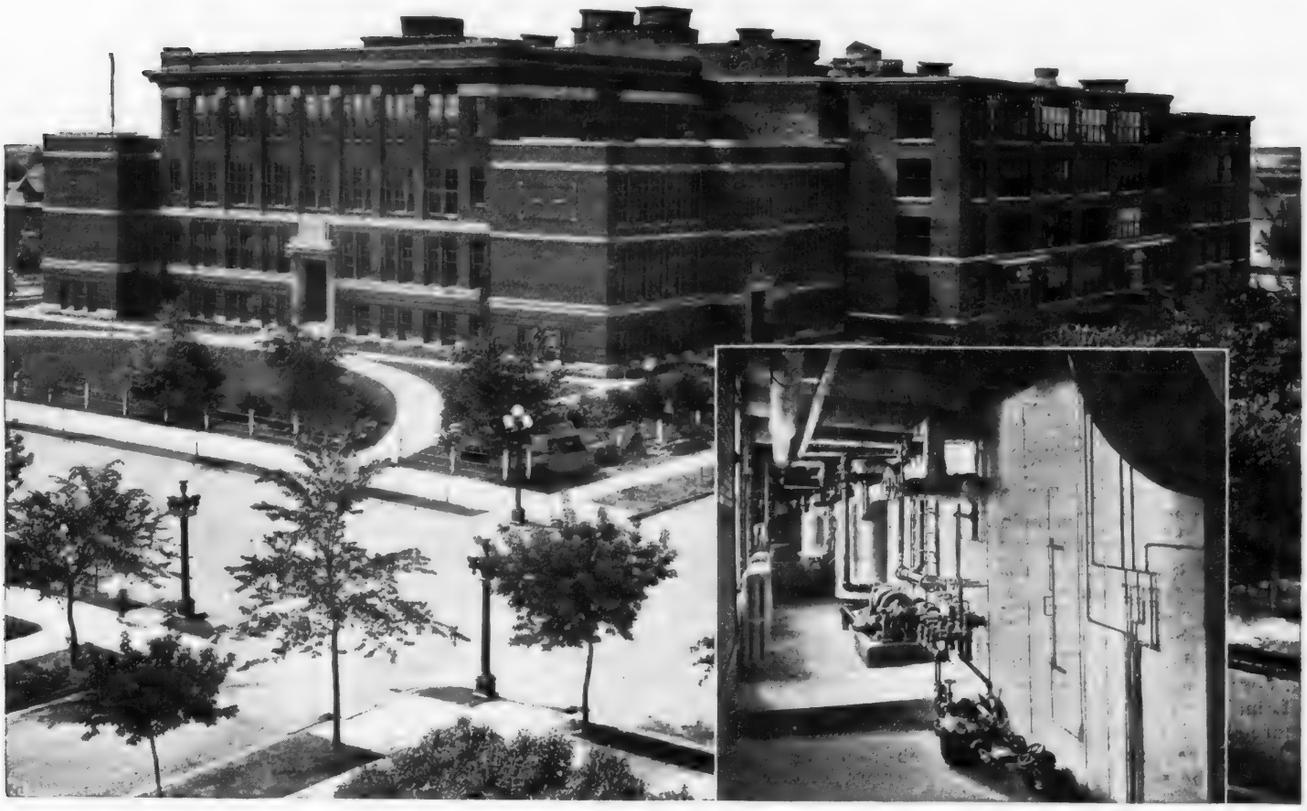
ILG ELECTRIC VENTILATING CO., 2858 N. Crawford Ave., Chicago

BRANCHES IN ALL PRINCIPAL CITIES



14 Carrier Air Washers and 27 Buffalo Fans are used in the Virginia, Minn., Vocational School
American Heating Co., Contractor

Everywhere youthful lives are conserved by Buffalo Heating & Ventilating Systems—Adults deserve and need just as much

You know how you could eat most anything, disregard draughts, and do many things when you were young you would not dare to do today.

The highest health authorities of this country have many times decreed the use of Buffalo Fans and Carrier Air Washers in schools and other public buildings.

If this combination, which takes many pailfuls of filth out of the air each week, is good for a vocational school it is surely good for the industries represented by departments in the school.

And there are indisputable statistics which show less time lost by sickness following installation of Buffalo Fans and Carrier Air Washers.

Let Dept. No. 36 tell you the whole story without obligation and help you sell these systems to industrial plants.

BUFFALO FORGE COMPANY

480 Broadway

BUFFALO, N. Y.

Hoffman, head of the Department of Applied Mechanics at Purdue.

Compressed Gas Manufacturers' Association, through the Liquid Carbonic Division, announces the establishment of an industrial fellowship in the Mellon Institute of Industrial Research at the University of Pittsburgh, for the purpose of classifying, studying and developing the uses of liquid carbon dioxide. The present incumbent of the Industrial Fellowship is Charles L. Jones.

Paul M. Lincoln, well known as an electrical engineer and a former president of the American Institute of Electrical Engineers, has been appointed director of the School of Electrical Engineering in the College of Engineering, Cornell University, succeeding the late Professor Alexander Gray.

National Trade Extension Bureau, Evansville, Ind., announces that a conference of State, local and field secretaries of associations of heating and plumbing contractors will be held at T. E. B. headquarters in Evansville, January 9-11, 1923. The purpose is to discover and discuss ways and means of making the associations function more effectively for the best interests of all concerned, and to discuss the problems of the secretary's job.

New York.—A notice issued by the Consolidated Gas Company of New York offering suggestions to consumers for economy in the use of gas has attracted the attention of the daily press, one comment reading, "when a big corporation urges the buyers of its product to use as little of it as possible, and gives them elaborate directions for cutting down consumption—and the size of their bills—there is no doubt about the existence of a real and serious scarcity."

Collier's Weekly for November 11, 1922, has an article by Harold Cary on "Save Coal and Keep Warm" which will interest heating engineers. The author reviews the advances in the art and quotes freely from the discussions before the American Society of Heating and Ventilating Engineers and from the reports of the society's Research Laboratory.

St. Louis, Mo.—Employees of the N. O. Nelson Mfg. Company have expressed their intention of erecting a memorial to the late N. O. Nelson, founder of the company, at LeClaire, Ill., the "City Beautiful." Each employee will give one day's pay towards the memorial, the form of which will be decided later. LeClaire was designed and laid out by Mr. Nelson for his employees, his own home being in the center of the city.

University of Texas, Austin, Texas, will build three new buildings to cost $1,000,000, one of which will contain a central heating and power plant for the institution.

New York.—The new Beth Israel Hospital, at Livingston Place and Seventeenth Street, New York, will be equipped with fuel-oil burning boilers. A 40,000-gal. tank is being installed to store the oil.

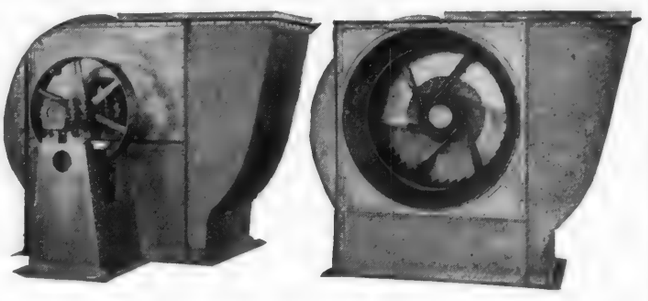
Chicago, Ill.—Chicago's third annual Own-Your-Home Exposition will be held in the Coliseum, Chicago, March 24-31, 1923. Among the co-operating organizations are the Chicago Master Steam Fitters' Association and the Chicago Master Plumbers' Association.

New Haven, Conn.—A conference between the building commissioners of New Haven and the local heating contractors was held recently to discuss the matter of the ventilation of the theatres of the city, with a view of deciding on recommendations along this line.

Decatur, Ill.—In connection with the new Community heating plant being established in Decatur, the H. Mueller Mfg. Company of that city is building the plant which will have a capacity to take care of the residences in four square blocks. Two No. 115 (60-in. x 17 ft. 10-in.) Kewanee down-draft smokeless firebox boilers are being installed. The steam generated will be reduced to 30 lbs. in the mains and further reduced to 1 lb. in the houses. The mains and returns are laid underground with a special non-conducting insulation and all are placed in split vitrified tile, with a 4-in. tile drainage under all the conduits. The plant was designed and is being installed under the supervision of W. E. Adams, a heating engineer, of Decatur, and the

LEHIGH

MULTIBLADE FANS



WHERE large volumes of air are to be handled at comparatively low pressures such as in heating and ventilating systems LEHIGH Multiblade Fans are guaranteed to be equal to, if not superior, to any other fans on the market.

A study of the capacity tables and characteristic curves in the Lehigh catalogue clearly proves this fact.

To further substantiate this statement, your attention is directed to the large inlet and outlet, the cone shaped hub, the absence of stay-rods, the rigid construction secured by special blades running tangent from the hub to the periphery of the wheel and also various other details.

May we send you a copy of our catalogue?

HERSH BROTHERS CO.

654 Mill Street ALLENTOWN, PA.

Have You a Ventilating, Drying, or Air Conditioning Problem?

Air is just as essential to many manufacturing processes as it is indispensable to life itself.

As pioneers in the development of apparatus for the handling of air—in research to discover the laws governing its control—and finally in successful application of its products, the American Blower Company offers you the benefits of practical experience extending over a period of nearly a half century.

If you have a heating problem—an air conditioning problem—a drying problem—a ventilating problem—a mechanical draft problem—an air conveying problem—any problem which requires fan or blower equipment—bring it to the attention of our engineers who will cooperate with you in the selection of equipment that will do the work satisfactorily and economically.

We will gladly send you bulletins describing American Blower Products, including fans, blowers, air conditioning equipment, mechanical draft apparatus, steam engines, heaters and steam traps.

AMERICAN BLOWER COMPANY, DETROIT
BRANCH OFFICES IN ALL PRINCIPAL CITIES
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONTARIO

(172)

American Blower

"Sirocco" TRADE MARK

EXHAUSTERS · VENTILATING FANS · AIR WASHERS · BLOWERS · ENGINES

FOR HEATING, VENTILATING, DRYING, AIR CONDITIONING, MECHANICAL DRAFT

system of insulation is one especially designed by him. Among the patrons of the plant is Adolph Mueller of the H. Mueller Mfg. Company.

Manufacturers' Notes.

J. W. Brazier, Columbus, O., sheet-metal construction engineer and contractor, has moved into his new plant at Michigan and Bulltles Avenues, where facilities have been provided for manufacturing four different systems for dust collection, factory sheet-metal work, and exhaust and ventilating fans.

Goetze Gasket & Packing Co., New Brunswick, N. J., announces the removal of its New York branch from 242 Lafayette Street to the Hudson Terminal. The company's New York sales representatives are King & Shepherd.

United States Radiator Corporation, Detroit, Mich., has commenced the erection of a new foundry at its plant in Corry, Pa., which will increase the radiator production at this plant about 50%. Foundry additions are also being made to the corporation's plants in Geneva and Detroit, which will increase the boiler output materially. It is stated that the company is also planning a new radiator plant in Detroit.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., announces through W. S. Rugg, general sales manager of the company, the following changes in the personnel of the company's district offices: In the Pittsburgh office, the Power Division has been changed to the Central Station Division, with Barth Stevenson as manager. Mr. Stevenson will also be in charge of the sale of supply apparatus throughout the entire Pittsburgh district.

A Transportation Division has been organized in the Philadelphia office and Thomas Cooper has been appointed manager. A Central Station Division has also been organized with H. L. Moody as manager. Mr. Moody will also be in charge of the sale of supply apparatus in the Philadelphia district, assisted by H. F. Brinckerhoff, who has been appointed assistant manager of the Central Station Division. W. P. Cochran will temporarily have charge of the Merchandising Division, which has been newly formed.

Similar changes have also been made in the Detroit office. A Central Station Division has been established with L. Whiting as manager. Mr. Whiting will also have charge of the sale of supply apparatus. F. D. Koelbel has been made acting manager of a newly-created Merchandising Division. A Transportation Division has been established with R. L. Herman as manager.

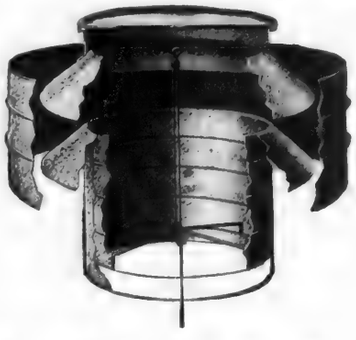
Changes in address have been made by the St. Louis and Los Angeles offices. The former office is now located at 717 South Twelfth Street, St. Louis, and the latter at 420 South San Pedro Street, Los Angeles.

Coppus Engineering Corporation, Worcester, Mass., is the title of the merger of the Coppus Engineering & Equipment Company and the New England Brass Foundry Company, both of Worcester. The company manufactures, among other products, the Coppus Vano blower for forced draft. The directors are: Franz H. C. Coppus, J. Verner Critchley, Frank A. Drury, Linwood M. Erskine, George A. Gaskill, Jerome R. George and William D. Luey. The plant of the foundry will be operated as a department of the company.

Sterling Engineering Co., Milwaukee, manufacturer of the Sterling line of heating specialities, has appointed the George W. Akers Company, 208 Stahelin Building, 3000 Grand River Avenue, Detroit, Mich., as its representative for Detroit and the southeastern portion of Michigan. Mr. Akers is well known in the Detroit field, having acted as manufacturers' agent there for several years past. He is a heating plant and power engineer and is thus in a position to render engineering service to architects and contractors.

Jenkins Bros., New York, manufacturer of Jenkins' valves and other heating supplies, announces the appointment of William G. LeCompte as sales manager in charge of its New York territory. The announcement states that "Mr. LeCompte has been a member of the sales organization of the company for a quarter of a century and his wide experience and knowledge of the engineering contracting and job-

BURT



The Burt Glass Top Ventilator is

IDEAL

Has sliding sleeve damper by which temperature of the building can be easily and exactly regulated.
This sliding sleeve damper, once adjusted, is held permanently in any position by a special attachment that does away with fastening the cord to a nail, hook or post. Due to its not having a flat service, the damper will not collect dust and refuse.

Economical

Impure and hot air, smoke, steam or gas taken out of any building automatically and without any expense other than the first cost of the ventilators.

Made and Guaranteed by

THE BURT MANUFACTURING CO.
261 Main Street AKRON, OHIO

Cycloidal MULTIVANE FANS
TRADE MARK

Heating and
Ventilating
Apparatus
Fans and
Blowers

Garden City Fan Co.
Manufacturers since 1879
McCormick Bldg.
CHICAGO

Eastern Office
Cochran & Wrightson
47 W. 34th Street
New York

Peerless Ventilator

BUILT RIGHT RUN RIGHT

The New York Blower Co.

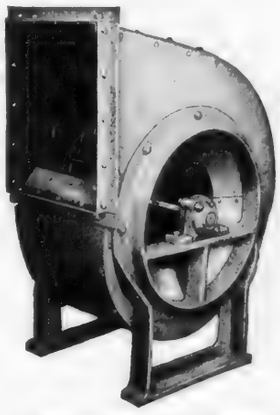
Chicago, Ill. La Porte, Ind.

Peerless Air Washer

We manufacture a complete line of fan equipment and appurtenances. By concentrating on this one class of products we are able to make them better every year.

Pulley Driven Disc Fan for Mines

The old fallacy that fan equipment was a luxury is now known to be untrue; it is an economical necessity. We can give actual installations in all kinds of industries where through the wise employment of fan equipment manufacturers have improved the quality of their product, and increased production with a reduction in factory cost.



Type "C" Seri-Vane Fan

If you are interested in drying, humidifying, heating, ventilating, mechanical draft, removal of shavings or similar installations, please communicate with us. If we cannot honestly prove facts to you showing the benefits that will follow from an installation for your special problem, we will frankly so state.

Motor Driven Propeller Fan

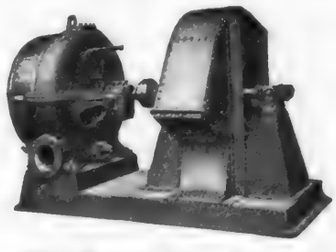
Slow Speed Planing Mill Exhauster

The New York Blower Co.

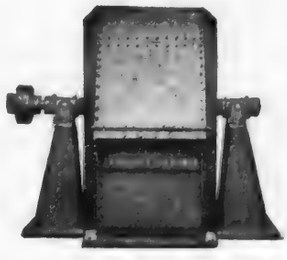
Chicago, Ill. La Porte, Ind.

Branch Offices in Principal Cities

High Speed Type "C" Seri-Vane Fan



High Pressure Blower Direct Connected to Turbine



Stoker Fan

bing field will merit your confidence and co-operation." Few men in the heating industry have a larger circle of friends and acquaintances than Mr. Le Compte who has already come in for a flood of congratulations on his new appointment.

Duro Pump & Mfg. Co., Dayton, O., manufacturer of residence water systems, has inaugurated a national sales campaign with unusual features. The campaign is termed a "National Good Fellowship Election," and the "voters" consist of orders. The sales force is divided into several divisions, with a "Commuters' Party" in the east and a "Ranchers' Party" in the west. The rules provide that the distributor making the largest percentage of his quota becomes president of the "Good Fellowship" Club, the next highest, vice-president and so on. All distributors making more than 100% of their quota are elected "senators." The salesman making the highest percentage of his quota is elected "Speaker of the House of Representatives"; the next highest, "floor leader," and so on. All salesmen making more than 100% of quota are elected as "congressmen." Prizes consisting of such articles as breakfat room sets, chest of silver, wardrobe trunks, golf bags and clubs, vacuum cleaners, electric sewing machines and others go with the election honors. In addition, an "Unnamed" and "Unknown" prize, termed the "President's Prize," is offered to the distributor selected as "President," and to the salesman elected as "Speaker of the House."

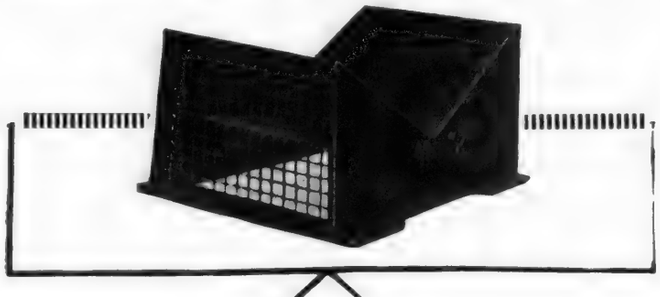
Pierce, Butler & Pierce Mfg. Corporation, New York, manufacture of boilers and radiators, has issued gold mortgage bonds in the amount of $2,500,000, bearing interest at 6½, to pay for the factory of the company in Eastwood, N. Y.

Excelso Specialty Works, Buffalo, N. Y., announces that "Lu" H. Drury, for sixteen years floor salesman for the American Radiator Company at its Chicago branch, is now associated with C. N. Stedman, Chicago district sales manager for the Excelso Specialty Works, with offices at 610 Wrigley Building, Chicago. In addition to handling the Excelso specialties, this office also has the agency for the Sylphon specialties, manufactured by the Fulton Co., Knoxville, Tenn.

Bishop & Babcock Co., Cleveland, O., held the annual conference of district sales representatives of its heating department at the home office, October 24-27. Those in attendance were: R. H. Gallagher, H. C. Duperow, H. M. Harris, R. D. Lombard, J. G. Gregory, S. Smith, W. Bohnert, J. V. O. Palm, E. P. Kerruish, S. Cown, H. Cohen, A. K. Park, A. M. Worden, W. Doud, F. R. Pleasanton, B. J. Kline and H. Patton, all of Cleveland; A. G. Reuter, Denver; D. F. Stevenson, Atlanta, Ga.; F. E. Dwyer, Amsterdam, N. Y.; H. Woolley and T. R. Woolley, Detroit; A. E. Hauschildt, Pittsburgh; L. Tierney, Max P. Miller and W. D. Cashin, Boston; Thomas Kellogg and W. R Pertak, New York; O. M. Alexander, Philadelphia; M. C. Beman, Buffalo; M. C. Beman and B. C. Candee, Buffalo; James Ryan, Nashville, Tenn.; W. B. Ricketts and E. Vernon Hill, Chicago; I. Hardeman, Charlotte, N. C.; C. F. Jordan, C. C. R. Lingo and C. Ludlow, Cincinnati; Fred Colbert, Dallas, Tex.; and Nathan Kohn, St. Louis. The conference was in charge of B. J. Kline, F. R. Pleasanton, W. Doud, H. M. Harris and A. M. Worden, heads of some of the company's various departments.

Republic Iron and Steel Co., Philadelphia, Pa., has appointed William H. Oliver as manager of the company's New York office. Mr. Oliver has long represented the company in Philadelphia and on the eve of his departure for New York, the officers and members of the Delaware Valley Trade Golf Association tendered him a testimonial dinner, the sentiment of his friends taking tangible form in a silver engraved cocktail set. George Bridgman acted as toastmaster at the dinner.

Reading Iron Co., Reading, Pa., has appointed Welling G. Titus as its representative in New York State and



The
"Camelback"
Air Diffuser

is a device which architects and engineers have found that by its use the desired volume of fresh air is introduced and distributed throughout the auditorium at a minimum of cost and friction loss.

BECAUSE

1. Less duct work is required, saving a great expense in masonry.
2. Its construction of two way air delivery at ends, permits the discharge of the maximum quantity of air with the minimum number of diffusers.
3. Its angular shape makes it uncomfortable as a foot rest.
4. Friction loss is negligible.
5. It admits of the use of the lowest slung chair seat.
6. It is made of heavy cast iron with wire screen over ends and is guaranteed to last.
7. It has two controlling dampers, regulated independently of each other and is furnished without dampers if desired.

Every Architect and Engineer owes it to his clients to be well informed on latest ventilating practices. For that reason you should be familiar with the "Camelback." Send for Blueprints.

Knowles Mushroom Ventilating Co.
202 Franklin St. New York City
Manufacturers of Knowles Aisle-Hood, and Mushroom Notch

THE IMPACT AIR WASHER

Comprises a number of important features.

Highly Effective Dust Removal

The "Impact" Washer is guaranteed to remove 95 per cent of such dust as is found in ordinary city air. Extra-intimate contact of air and water is effected by the use of nozzles of our "Impact" type which due to their special construction and arrangement produce a dense and uniform mist or spray.

Uninterrupted Service

The "Impact" type of nozzle produces a flat, fan-shape spray by the impact of two jets from large smooth orifices, there being no internal spirals or passages whatever to become clogged with sediment. For the further prevention of plugging our special scale arrester is placed just back of each spray head. This arrester with its numerous holes each slightly smaller than the nozzle orifices, intercepts and retains all bits of sediment and scale which would not pass the nozzles. The accumulation on this strainer is slow and is quickly removed while washer is operating.

Other exclusive features. Ask for Booklet K.

THE COOLING TOWER CO., INC.

15 John St., New York

A Silent Mechanical Ventilating Unit For Each Room

UNIT HEATING AND VENTILATING SYSTEM

BUCKEYE SERVICE

BUCKEYE QUALITY

HEATOVENT

Simple in construction and silent in operation, the Heatovent is always ready to serve you. It insures perfect ventilation at all times, free from any drafts.

The Heatovent is the ideal Unit Heater, as it incorporates all of the best engineering principles and designs. It starts by pressing a button and it stops the same way.

The Heatovent is of simple, artistic design, finished to harmonize with any interior. It is the latest heating and ventilating system for schools.

The Steel Cabinet encloses a special new style steam coil designed to give the highest possible heat transfer at low air velocity; it, also encloses a pair of special slow speed Multiblade Fan Wheels direct-connected to a specially designed electric motor built to our specifications.

All of these specially built features make the Heatovent the quietest and most economical Unit Heater now being manufactured.

The fresh air is drawn into the cabinet, tempered to proper degree, and then diffused into the room through louvres near the top of the cabinet.

Send us your plans and we will submit specifications and figures without obligation to you.

BUCKEYE BLOWER CO.

TOWN AND LUCAS STREETS COLUMBUS, OHIO

Branch Sales and Engineering Offices:

BUCKEYE BLOWER CO.
324 Monadnock Bldg.
CHICAGO, ILL

BUCKEYE BLOWER CO.
372 White Hall St.
ATLANTA, GA.

BUCKEYE BLOWER CO.
503 Wabash Bldg.
PITTSBURGH, PA.

BUCKEYE BLOWER CO.
1400 Broadway
NEW YORK, N. Y.

Pennsylvania, east of Pittsburgh. Mr. Titus was for a long time connected with the Trenton Potteries Company, having served the company in various capacities during his 21 years with the company. For five years he was the company's general sales manager.

Thermal Appliance Co., New York, announces the appointment of Sanborn & Lindeblad, McCormick Building, Michigan Ave., Chicago, as its representatives in Illinois, Minnesota, Iowa, Wisconsin, Missouri, North Dakota and South Dakota.

American Radiator Co., Buffalo, N. Y., will build a new plant to cost $1,000,000 in St. Paul, Minn., at Prior and Minnehaha Streets. The plant will occupy part of a site of fifteen acres recently acquired by the company and will serve the entire Northwestern territory.

Imperial Radiator Co., Ltd., has been organized to take over the assets of Steel and Radiation, Ltd., of Toronto and St. Catherines and has established headquarters at St. Catherines, where it is operating the plant there. This will be the only manufacturing plant of the company. The officers are: President, J. E. McAllister; general manager, E. T. Wingate; secretary, E. M. Stokes; consulting engineer, W. R. Backall. The plant of the former Steel and Radiation in Toronto will be sold.

Cochran-Sargent Co., St. Paul, Minn., will open a branch house in Fargo, N. D., in the building formerly occupied by the Dempster Mill Mfg. Company, which the company has purchased. The manager is M. Camitsch.

Carrier Engineering Corporation, Newark, N. J., announces that by arrangement with the manufacturers of approved heads and specialties, the company's piping division is now ready to contract for the complete installation of automatic sprinkler systems for fire protection anywhere in the United States or Canada. George G. Schmidt, head of the company's piping division, will have this new service under his personal supervision.

Elevator Supplies Co., 1515 Willow Ave., Hoboken, N. J., announces the appointment of B. K. Strader to its sales force. Mr. Strader was for many years connected with the Westinghouse Electric & Mfg. Company as sales engineer.

Central Station Heating Notes.

San Francisco, Cal.—Reduction of steam heat charges is asked in two petitions which have been filed with the State Railroad Commission by Attorney Albert I. Lieb, Crocker Building, in behalf of some 50 consumers of steam heat in San Francisco and Oakland. The reduction is asked on the ground that the rate fixed by the commission in 1920 is now "exorbitant, unreasonable and unjust," inasmuch as fuel-oil, the only commodity involved, sold at that time at from $2.00 to $2.35 a barrel of 42 gal. in San Francisco and other bay cities, whereas at the present time, it is claimed, the prevailing approximate price at the plants is 95 cents a barrel of like capacity. The railroad commission, which was given control of heat corporations when the 1919 legislature amended the public utilities act by declaring same public utilities, is asked by Attorney Loeb, in behalf of his clients, to readjust the rates involved "to harmonize with the price of fuel-oil."

Salt Lake City, Utah.—A new building to contain two new boilers, and a 206-ft. smoke stack, are now under construction as additions to the steam heating plant of the Utah Power & Light Company. The new plant is located in the center of the block west of Temple Square. The steam heating department of the company is an active factor in the campaign for the elimination of smoke in Salt Lake City. The system at present supplies heat to 75 of the largest buildings in the city, serving the territory from Fourth South to North Temple and from State Street to West Temple. It is intended that the system will be expanded until a net work of lines covers the congested business district supplying steam heat to all of this section. Since its beginning in 1916, all work done on the steam heating plants and mains has been of a permanent character and designed to form part of the projected system.

At the present time the South Temple plant is overtaxed, and it is to permit this plant to adequately care for its

WOOLWORTH BUILDING
NEW YORK CITY

-WOOLWORTH-BUILDING-NEW-YORK-CITY-

The highest and most magnificent office building in the world. Has over 23,000,000 cubic feet of Air kept in motion every hour by fourteen

MASSACHUSETTS BLOWER CO.

Fans. Fans for every purpose and need.

Factory, WATERTOWN, MASS.

JAMES M. SEYMOUR

Established 1888

Lawrence St., Mechanic St. and Kirk Place

NEWARK NEW JERSEY

PROPELLER TYPE FANS

Many styles for many kinds of service. Low pressure Fans that deliver immense volumes of air at low velocity.

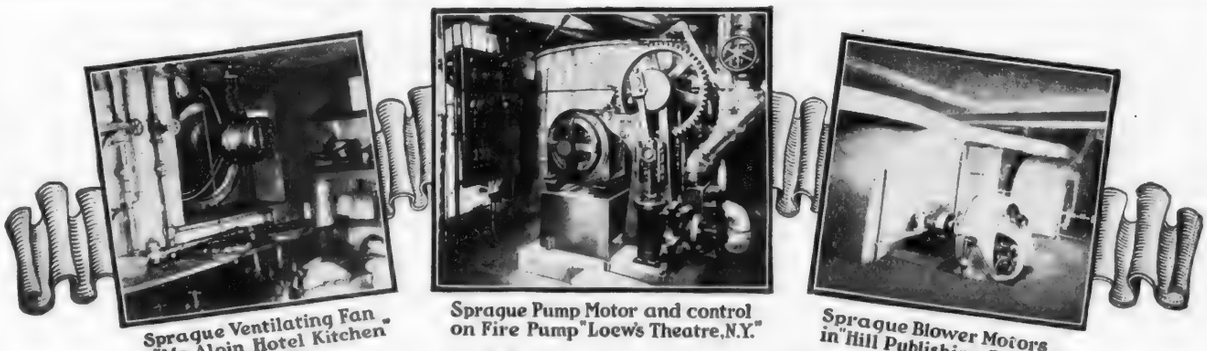
Cone cased Fans for higher pressures, Extreme Fans for high pressure and high velocity.

Compound Fans from 11 feet in diameter to 24 feet in diameter for Mine Ventilation.

Hyatt Roller Bearings. Anti-Friction Metallic wick, self-oiling bearings, and Ball Bearings if the purchaser prefers.

SEYMOUR FANS are not an experiment. Over 100,000 now in service. Built of the best materials. Good Workmanship. Commercially Attractive Prices.

SEND FOR BULLETINS



Sprague Ventilating Fan in "Mc Alpin Hotel Kitchen"

Sprague Pump Motor and control on Fire Pump "Loew's Theatre, N.Y."

Sprague Blower Motors in "Hill Publishing Plant"

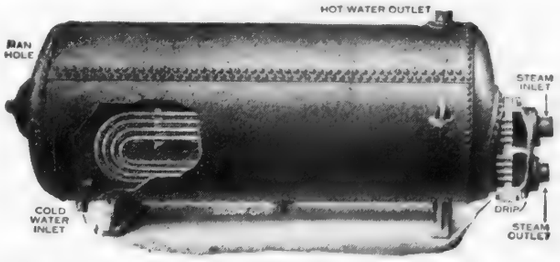
SPRAGUE EQUIPMENTS SATISFY

It Pays to Put in Equipment that Satisfies

Sprague Ventilating Fans, Pump Motors, and Blower Drives have stood the test of time. You will find them doggedly doing service, day and night, down in the vitals of many conspicuous buildings in our great cities.

They can be depended upon. They are made *right* and are backed by one of the oldest manufacturers of electrical apparatus in the United States. Write our nearest Branch Office today.

SPRAGUE ELECTRIC WORKS
Of General Electric Company
Main Offices 527 W. 34th St. New York
PIONEERS OF THE INDUSTRY
Branch Offices in Principal Cities



The Patterson Combined Hot Water Service and Storage Heater.

The proper "balance" between the storage & heating capacities

in any heater is necessary to secure satisfactory service.

If this necessarily important feature is overlooked or not properly provided for when the heater is designed, it will neither be satisfactory to the purchaser nor operate efficiently.

Our long experience in designing and constructing Hot Water Service Heaters—for all domestic and industrial purposes—is offered to Heating, Ventilating and Sanitary Engineers.

It implies no obligation to consult with us.

Patterson-Kelley Co. 107 East 40th St. **New York**

present business that the new additions are being constructed. One boiler is under process of erection now, and the other will be built later.

Vancouver.—Three applicants, Consumers' Central Heating Co. of Tacoma, Adkinson & Dill of Vancouver, and the Vancouver Steam Manufacturing Co. of Vancouver, are bidding for the contract to construct a central heating plant for this city. While the contract has not yet been let, it is stated by the city council that the successful applicant must undertake to spend in the purchase of the site and plant within one year, the sum of $25,000, must also put up cash security of $10,000 and guarantee the city against claims for damages of any kind by putting up a further bond of $25,000. The company must also, within one year, have a mile of pipe in operation and within thirty months, two miles. The agreement will further include the clause that "reasonable rates" must obtain, the council reserving the right to prescribe by by-law, the rates it considers "just, fair and reasonable."

New Incorporations.

Lyon Heater Co., 2008 Central St., Evanston, Ill., to acquire and deal in heating and plumbing supplies. Incorporators: Clifford W. Lyon, J. W. Gage, Charles Shoreen. Correspondent, Bucklin & Scheunemann, Conway building, Chicago.

Lorne Plumbing & Heating Co., Detroit, Mich., capital $35,000, to take over the business of Lorne, Couse & Lorne, 641 Congress Street.

Federal Plumbing & Heating Co., 6 East Kinzie St., Chicago, Ill., to conduct a heating and plumbing business. Incorporators: Robert J. Farrell, John Burke, and Margaret Farrell. Correspondent, Matthew E. Clark, 1026 South May St.

Foersterling & Bottenfield, Inc., 527 Main St., Peoria, Ill., capital $5000, to deal in heating appliances and electrical specialties. Directors: F. J. Foersterling and B. P. Foersterling, 209 South Underhill St.; and M. E. Bottenfield, 705 North Jefferson Avenue.

Harry Verbeck Co., 3616 Iroon St., Chicago, Ill.; capital $50,000, to deal in heating, plumbing and engineers' supplies, etc. Incorporators: Harry Verbeck, D. C. Verbeck, M. B. Flynn. Correspondents, Lyman, Adams & Bishop, 1610 Title and Trust Building.

Dependable Oil Vapor Heater Co., 149 West Grand Ave., Chicago, Ill., organized to manufacture oil-burning appliances. Incorporators: George B. Johnson, Abram E. Mabie and Charles A. Gleason, all of Chicago.

Blanchard Plumbing & Heating Co., Seattle, Wash., capital $10,000. Incorporators: Louis J. Blanchard, Hanna Blanchard and Edward Whitesel.

Contracts Awarded.

Carlson Bros. Sheet Metal Co., Superior, Wis., heating and ventilating new high school at Altoona, Pa., for $40,000. This company also has contracts for heating and ventilating systems in the new high school at Houghton, Mich.; the addition to the Michigan State Normal School at Marquette, and the large new high school at Ottumwa, Ia.

Ed. J. Hammel Co., Hammel, Mich., heating No. 2 body plant of the Michigan Iron, Land and Lumber Company at Iron Mountain, for $18,000. More than 12,000 ft. of 1½-in. pipe is to be used.

W. J. Scholl Co., Youngstown, O., heating and ventilating Adams and Princeton additions. The cost of the Adams installation will be $48,200, and that of the Princeton addition, $62,507.

D. R. Black Co., Duluth, Minn., heating, ventilating and plumbing addition to the Emerson School in Duluth, for $32,500.

C. F. Rock Plumbing & Heating Co., St. Joseph, Mo, heating and plumbing for 160,000 addition to the Oakdale Sanatorium at Iowa City, Ia.

Columbus Heating and Ventilating Co., Columbus, O., heating and ventilating new school building in Dayton, O., for $16,900; the plumbing contract went to Beacon & Sanders, at their bid of $5,937.

Just ONE or TWO WING-SCRUPLEX UNIT HEATERS

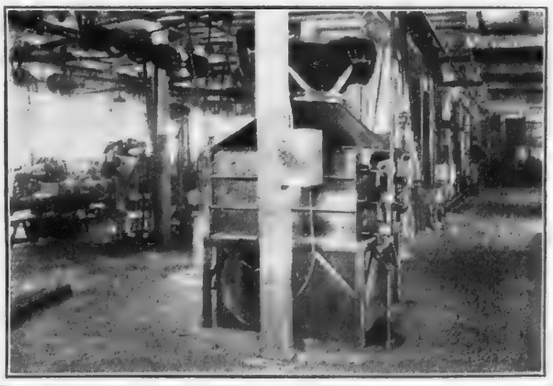
REG. U.S. PAT. OFF.

Will heat a large building in a shorter space of time and at considerably less cost than 30 or more small direct radiators.

Wing-Scruplex Unit Heaters are combined fans and heaters. They circulate heated air by mechanical means, directing the air downward to the floor or working level. The circulation is positive and uniform without the use of distributing ducts or pipes.

Circulation with direct radiators depends upon gravity; warm air rises to the ceiling, colder or heavier air drops to the floor; result—cold floor and overheated ceiling, with enormous waste of fuel.

Wing-Scruplex Unit Heater system of heating costs less to install and to operate than any other known system. Write us for further information.



L. J. Wing Mfg. Co.

Fans and Blowers — Unit Heaters
Small Turbines — Damper Regulators

HUDSON & 13th STS., NEW YORK CITY

Vento Return Line Valve

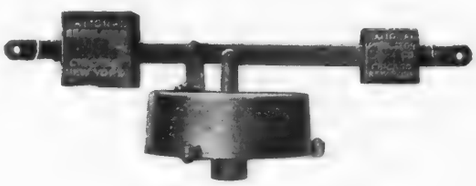
for Vacuum and Vapor Heating Systems is a fuel-saver from the moment that it is put to work on the heating system. It never fails in its promise to make the heating system give dollar-for-dollar service for every ounce of fuel consumed. Our latest Booklet, "The Perfect Heating System," will be mailed on request to any heating engineer.

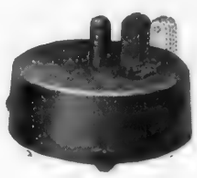
WM. S. HAINES & COMPANY
PHILADELPHIA

STEAM TRAPS AIR TRAPS — STEAM SEPARATORS EXHAUST HEADS — OIL SEPARATORS BOILER ALARM WATER COLUMNS — STRAINERS

WRIGHT — WA Standard with STEAM USERS SINCE '94 — **AUSTIN**

WRIGHT-AUSTIN CO. — DETROIT, MICHIGAN





The New Metaphram Damper Regulator

We Manufacture

A complete system of apparatus for regulation of temperature and humidity for all types of buildings.

National Tank Regulators for the control of hot and cold water in tanks, reservoirs, drinking water systems, etc.

High and low pressure metaphram boiler regulators.

Expansion valves for the control of gas engines, hot water boilers and condensing coils.

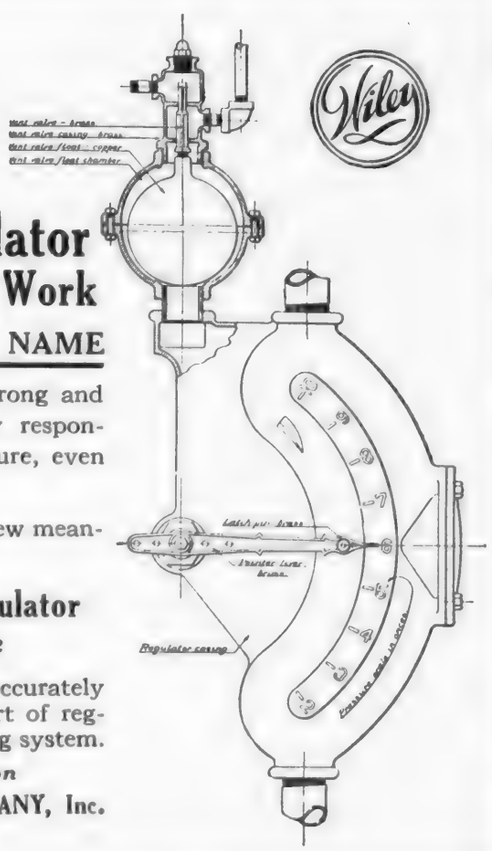
Thermostatic controllers for industrial processes, metal melting pots, annealing ovens, kilns, linotype kettles, cookers, dryers, grain dryers, air washers and humidity control, glue pots, etc.

Reducing valves, gauges, thermometers, hydraulic and electric air compressors.

NATIONAL REGULATOR CO.
FACTORY AND GENERAL OFFICES
208-212 South Jefferson Street
CHICAGO

AS we studied the requirements of present day low-pressure steam, hot water and vapor heating, we saw a need for a Metaphram Damper Regulator that would be best for medium-large house heating boilers at a price below that of our Type C-7" and with a lift and power greater than those of our 4-inch regulators. As a result we designed our Type B-5½ inch, which offers manufacturers and users a most desirable equipment at a lower price. We added a most important feature in our new Offset Fulcrum, which makes it possible to adjust the lift and power of the lever through a simple adjustment of the staggered fulcrum, as is clearly shown in the accompanying illustration. Specifications: We equip this new Type B-5½" with a 40-inch lever, adjustable weights, two ceiling pulleys and 12 feet of No. 0 plumber's chain. Unlike the 4-inch size, this type has a ½-inch female connection instead of male. Shipping weight: 20 pounds.

TRADE METAPHRAM MARK
REG U S PAT OFFICE



Wiley

A Super-Regulator for Vapor Heating Work

POWER IS ITS MIDDLE NAME

Draft dampers are controlled with strong and steady graduated movement, accurately responsive to slightest change in boiler pressure, even to the fraction of an ounce.

A vapor or modulating system has a new meaning when hooked to the boiler with a

Wiley Safety Vent Vapor Regulator
built for lifetime service

All working parts of cast bronze, accurately machined. Safety-Vent-Valve forms part of regulator and handles air from entire heating system.

Write for prices and full information

SIMPLEX HEATING SPECIALTY COMPANY, Inc.
LYNCHBURG, VA.

McClintock Bros., Philadelphia, heating 25-room school at Third and Duncannon Streets for $45,300; also heating 25-room school at Germantown Avenue and Southampton Street, for $45,000.

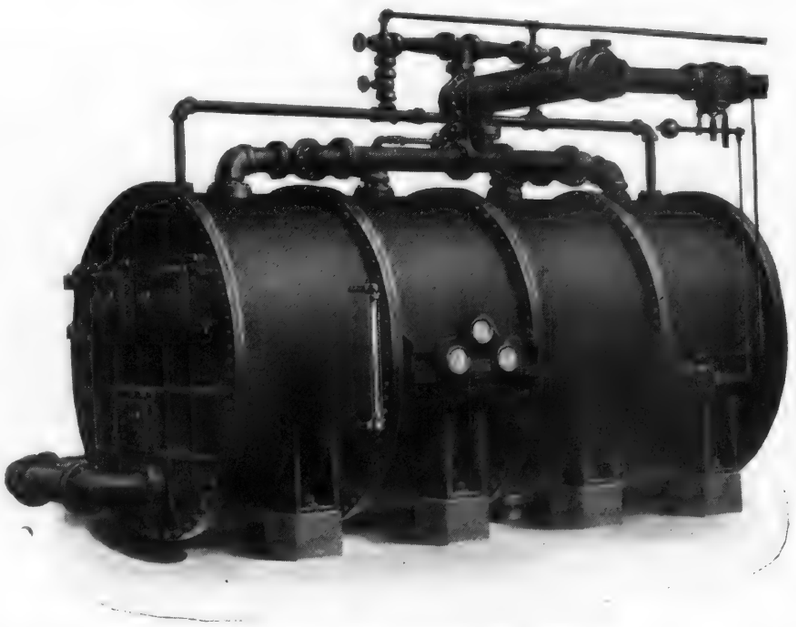
Thompson Bros., Philadelphia, Pa., heating 38-room school at Ninth Street and Oregon Avenue, Philadelphia, for $47,800.

Wm. Howlett Co., Philadelphia, Pa., ventilating three school buildings in Philadelphia for $1409, $1860 and $1409, respectively.

Stone & Underhill, Lynn, Mass., heating and ventilating high school building in Revere, Mass., for $14,987.

Samuel A. Esswein Co., Columbus, O., heating and ventilating Ninth Avenue School, Columbus; the plumbing contract went to the Fitzpatrick & Hoepfner Company, of Columbus.

W. G. Cornell Co., New York, heating, ventilating, plumbing and gas-fitting the new $2,500,000 home of the Chamber of Commerce of the United States, in Washington. Work on the building is now under way and it is expected that the structure will be completed within one year. The architect is Cass Gilbert, of New York. Included in the building, which will be occupied entirely by the Chamber of Commerce, will be an auditorium extending through three stories of the main building, with a seating capacity of 850.

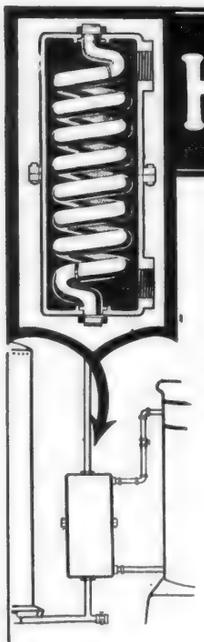


COCHRANE VACUUM DEAERATING HEATER.

Bakersfield Plumbing Co., Bakersfield, Cal., heating, ventilating and plumbing addition to the Kern Union High School for $20,637.

The Cochrane Vacuum Deaerating Heater.

As announced in THE HEATING AND VENTILATING MAGAZINE for November, the H. S. B. W.—Cochrane Corporation, Philadelphia, Pa., is now marketing an apparatus for supplying oxygen-free water at reduced temperatures to boilers. The general appearance of this heater is shown in the accompanying illustration. It has been the object of numerous experiments which are given in detail in a leaflet published by the company which



PLENTY OF
HOT WATER
NO EXTRA EXPENSE

The most approved and economical method of heating water for domestic purposes. An abundant supply of hot water at just the right temperature, 24 hours a day, at practically no extra cost. Easily connected to outside of steam, vapor or hot water boiler; does away with fuel-wasting coil in fire pot, uses surplus heat of boiler. Does not overheat or underheat. Will not burn out, once installed.

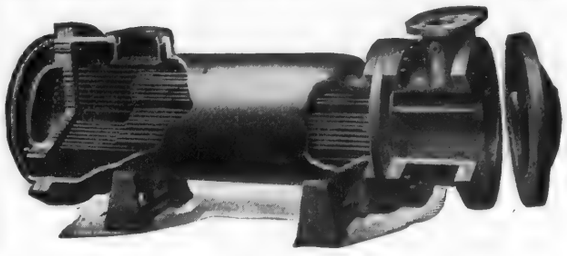
An unusual opportunity for live dealers. Order now and be prepared for the demand being created. We furnish cooperation and practical sale helps to give you full benefit of our national advertising. Write for full details.

The Hotstream Heater Co.
"Makers of Heaters that Heat"
Cleveland, Ohio

The Hotstream
INDIRECT WATER HEATER

We also make a complete line of Gas and Kerosene Water Heaters.

Perfect
Hot Water Service



G-R
Instantaneous Heater

Uses either live or exhaust steam
Send for Bulletin 231

THE GRISCOM-RUSSELL CO.
2155 West Street Building
NEW YORK

JOHN SIMMONS CO

110 CENTER STREET, NEW YORK

DISTRIBUTORS OF

"NATIONAL" Tube Steel Pipe

"BYERS" Wrought Iron Pipe

JARECKI MALLEABLE AND CAST FITTINGS

POWELL HIGH-GRADE VALVES

AND SPECIALTIES FOR

AUTOS, TRUCKS, GAS, GASOLINE and OIL ENGINES

WE CARRY IN STOCK

"A. B. C. DETROIT" Return Traps

PLUMBING SUPPLIES

FIRE FIGHTING EQUIPMENT

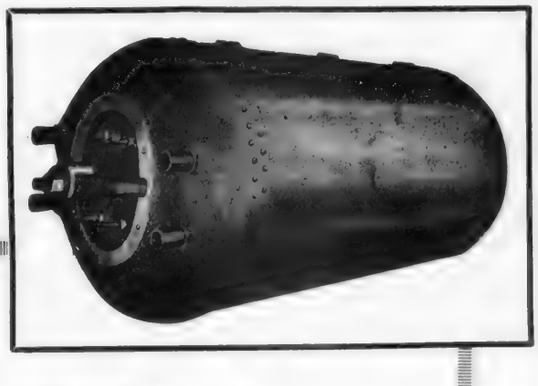
PIPE BENDS and COILS

In Iron, Steel, Brass and Coppe·

VAN STONE JOINTS

WELDED HEADERS

HAVE YOU A COPY OF OUR CATALOGUE IN YOUR FILE FOR READY REFERENCE?



For Durability

For Service

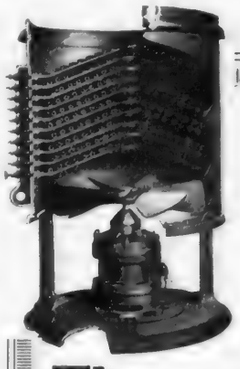
For Economy

For Personal and Client Satisfaction

SPECIFY

Dahlquist Copper Boilers

Dahlquist Manufacturing Company
40 West 3rd St. Boston, Mass.



A Convenient Heating Unit

easily installed for either temporary or permanent heating service.

The *Bayley* B.T.U.

is a complete self-contained heating unit with a heating surface consisting of individual spiral radiator coils one above the other (individually valved if desired). Heat is uniformly distributed by forcing the cooler air along the floor line through these coils by means of an electrically driven fan, thus creating a steady stream of tempered air and producing uniform temperature throughout the room. To install simply set on floor and connect steam and return piping and wiring to motor.

Send for bulletin today.

Bayley Mfg. Co.
Dept. "E"
MILWAUKEE, WISCONSIN

contains also much information on the action of rust on iron and steel.

Frank T. Chapman Made General Manager of Hargrave Service Company.

Frank T. Chapman, formerly Eastern district manager of the Industrial Sales Department of the American Radiator Company, specializing in Vento radiation, has been appointed general manager of the Hargrave Service Systems, with offices at 25 West 43rd Street, New York.

The service which is being rendered by the Hargrave Service Systems at this time is a scientific salesmanship service, dealing with fundamentals of human nature in connection with sales. This service is designed to promote a prompt and important increase of sales and profits and is attracting attention for this reason, and also because it deals almost entirely in fundamentals which apply to all classes of selling.

New Firms and Business Changes.

Davis-Billings Corporation, 58 Sutphin Boulevard, Jamaica, N. Y., has been organized by P. Lloyd Davis, formerly superintendent of E. G. Woolfolk & Co., New York, to engage in contracting and engineerng work in power and heating.

F J. Low, Inc., 15 West 44th St., New York, is the title of a new advertising agency which has been formed by F. J. Low, who recently resigned as vice-president of the agency with which he was associated for more than six years. Mr. Low is well known in the technical advertising field, having been for many years advertising manager of the H. W. Johns-Manville Company. He has also been associated with the advertising of many other firms, including the American Steam Gauge & Valve Mfg. Co., the Schaeffer & Budenberg Mfg. Co. and Sarco Co., Inc. The company announces that it is prepared to map out and execute every detail of an advertising campaign, including advertisements, booklets and circulars.

WANTED

Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

Wanted. — Heating and ventilating engineer and draftsman capable of taking off piping layouts and estimating complete power plant equipment. State experience and salary expected. Address Box 30, care of Heating and Ventilating Magazine.

Position Wanted.—Heating and ventilating engineer now employed desires permanent connection with reliable architect, consulting engineer or industrial concern. Capable of handling design, installation and maintenance. Technical graduate with practical experience. Licensed professional engineer. May 1 connection preferred. Address Murray, care of Heating and Ventilating Magazine.

BUSINESS OPPORTUNITY. — A man with an acquaintance with the architects and heating contractors of Cleveland, O., and also the architects of Youngstown and Toledo, O., has a proposition to offer a boiler and radiator manufacturer, or other line, where the above would be valuable. Address Box 20, care of Heating and Ventilating Magazine.

SALESMAN WANTED.—A manufacturer of ventilating apparatus in the New York district has an opening for a young man connected with the heating and ventilating field with ability to develop into an engineering salesman for the company's products. First-class opening for young man with training, energy and ambition. Address Sales Department, care of Heating and Ventilating Magazine.

St. Paul, Minn.—Among the requests which the finance committee of the Board of Regents of the University of Minnesota will present to the State Legislature when it meets in January will be for an appropriation of $100,000 for an additional heating plant unit to provide for the new buildings now under construction at the university.

REAL OPPORTUNITY
for
SALES REPRESENTATIVES

For a quarter century, we have manufactured hand stokers, gravity stokers and grates of a superior type. We are firmly entrenched in our field. Now we are offering a hand stoker which we guarantee to:—

—Save 10% to 30% fuel.

—Eliminate Smoke.

—Get more power out of coal consumption.

These stokers are in successful operation in many of the most prominent office, industrial and apartment buildings in the country. They are a success and should attract heating and power apparatus salesmen, preferably those who have an established clientele.

To the man who qualifies in each territory, an attractive sales proposition will be made. He must be of ripe judgment and experience, able to meet big men on an equal footing and produce results. Such men will be backed intensively by the home office, furnished leads from our advertising and given every possible cooperation. In your letter, tell everything which will enable us to judge you fairly and state what headquarters you propose to maintain and what territory you propose to cover. We have no objection to men selling non-competing heating or power apparatus.

Write at once in full and

Address H. W. S.
21st Floor, Wrigley Bldg, Chicago, Ill.

WANTED

COMPETENT FAN ENGINEER

Capable of designing and developing a complete line of standard and high speed heating and ventilating fans. Position permanent. Location, Middle West.

ADDRESS BOX WD
Heating and Ventilating Magazine

DEPENDABILITY!

SYNONYMOUS WITH STANDARD "Metallic" THERMOMETERS

DURABLE
DEPENDABLE
EASY TO READ
PRACTICALLY INDESTRUCTIBLE
SENSITIVE TO CHANGING TEMPERATURES

WARRANTED ACCURATE

Standard "Metallic" Thermometers are built for long and reliable service—backed by our experience of nearly forty years as Thermometer Manufacturers—made in INDICATING or RECORDING type, with ANGLE or STRAIGHT STEM. Write us about your requirements or send for descriptive booklet. We have a variety of sizes and models from which you can select your STANDARD "Metallic" THERMOMETERS.

STANDARD THERMOMETER CO.
Clifton St., Boston 19, Mass.
Nearly Forty Years as Thermometer Manufacturers

BAILEY METERS

BAILEY FLUID METERS record and totalize the flow of steam at any pressure or temperature, boiler feed, condensate, circulating water, or, practically any fluid flowing in a pipe. These meters are ideal for the measurement of low pressure steam as used for heating, because pressure and temperature records may be included on the same chart, giving the complete story of the steam supply. This makes it possible to calculate the actual B. T. U. supplied to a customer, and is conclusive evidence in case of any question regarding the supply. The pressure compensator has been in service for some little time. This device automatically corrects the totalizer readings for pressure changes, so that actual steam flow may be read directly from the meter.

BAILEY BOILER METERS accomplish more real results toward obtaining maximum efficiency and capacity from boiler operation than all other meters or instruments combined, because they record rate of Steam Flow from the boiler, the Rate of Air Flow through the furnace, and the Flue Gas Temperature on a single uniformly graduated chart. The Steam Flow shows the rate of steam production. The Air Flow shows the amount of air supplied for the support of combustion. The relation between these two records shows an excess or a deficiency of air supplied for the support of combustion. The Flue Gas Temperature is a sure indication of the condition of baffles and heating surface when considered in conjunction with the other records. Wind Box Pressure and Stoker Speed as well as a totalizer for the Steam Flow may be added.

BAILEY WEIR METERS record and totalize flow of water or other liquids through V-Notch weir and are used for feed water, hot well discharge or other fluids at or near atmospheric pressure.

Other Types of Meters as well as Recording and Indicating Gauges are made for different purposes, and nearly any problem in connection with the metering of fluids can be handled. Descriptive Bulletins sent on request.

BAILEY METER COMPANY
2037-E 46th ST. CLEVELAND, OHIO

Heat Regulation

For years automatic heat regulation has been regarded mainly as a successful means of maintaining temperature comfort. But with the advent of high priced fuel and labor, it has come emphatically into its own as a great economizer. Now no architect or engineer considers his plans complete unless they embody this important provision for his client's comfort, convenience, and economical advantage.

The Powers Automatic Temperature Control Serves Best

The true gradual action of the ***Powers Vapor Disc Thermostat*** makes this absolutely certain. Moreover, it serves perfectly year after year without adjustments or repairs. That's why so many architects and engineers ***specify*** and ***insist*** on a Powers installation.

Our Bulletin 150, only four pages, will be found interesting and profitable reading. It's yours for the asking.

For more than thirty years we have been solving heat regulation problems with automatic control. Our experience is at your service.

THE POWERS REGULATOR CO
Specialists in Automatic Heat Control

2718 Greenview Ave. CHICAGO NEW YORK BOSTON

Baltimore, Md.	El Paso, Tex.	Pittsburgh, Pa.
Buffalo, N. Y.	Indianapolis, Ind.	Portland, Ore.
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Charlotte, N. C.	Los Angeles, Calif.	Salt Lake City, Utah
Cincinnati, O.	Milwaukee, Wis.	San Francisco, Calif.
Cleveland, O.	Minneapolis, Minn.	Seattle, Wash.
Des Moines, Ia.	New Orleans, La.	St. Louis, Mo.
Detroit, Mich.	Philadelphia, Pa.	

The Canadian Powers Regulator Co., Ltd., Toronto, Ont.

Calgary, Alta. Halifax, N. S. Montreal, Que.
Vancouver, B. C. Winnipeg, Man.

(2028A)

INSULATION MEANS CONSERVATION

At all times, more especially these times of high coal prices, INSULATION means CONSERVATION of fuel.

Make that exposed hot surface a permanent, high paying investment by insulating it with

BANNER ROCK WOOL JACKET

100% FIREPROOF

HOT SURFACE INSULATION

Adaptable for Temperatures up to 800° F.

BANNER ROCK PRODUCTS COMPANY

ALEXANDRIA **INDIANA**

CHICAGO: 1502 Monadnock Bldg. **ST. LOUIS: 1310 Syndicate Trust Bldg.**

FOR UNDERGROUND STEAM OR HOT WATER PIPES

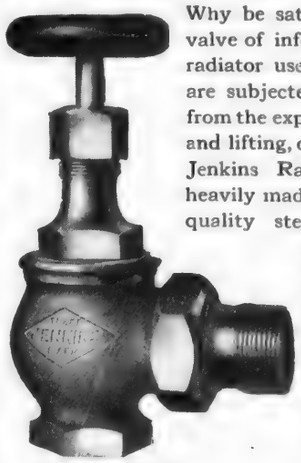
THE ORIGINAL RIC-WIL METHOD

embodies more original ideas, more advanced engineering, and more good practical features than any other system on the market. The material, construction, installation methods and practical results which, combined, form what we call the RIC-WIL Method, appeal with equal force to the engineer, to the practical operating man and to the business executive. Let us send you a copy of our descriptive Bulletins 1-3. Write to-day.

The RIC-WIL COMPANY CLEVELAND

TRADE JENKINS MARK Jenkins Bros

RADIATOR VALVES get heavy service, too



Why be satisfied with a light valve of inferior grade even for radiator use? Radiator Valves are subjected to severe strains from the expansion, contraction, and lifting, or settling of piping. Jenkins Radiator Valves are heavily made of the same high quality steam metal as used in larger Jenkins valves They are built to withstand rigorous treatment.

Look for the Jenkins Diamond and Signature cast on the body At supply houses everywhere.

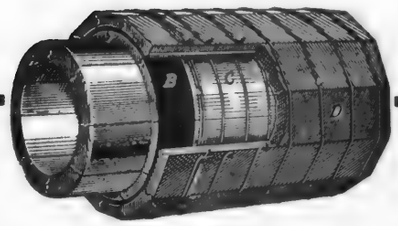
Fig. 168.— Jenkins Brass Radiator Angle Valve with wood wheel and union.

JENKINS BROS.

New York Boston
Philadelphia Chicago
Montreal London

Factories: Bridgeport, Conn.; Elizabeth N. J.; **Montreal, Can.**

Jenkins Valves SINCE 1864



A—Inner Shell, 2 inches thick.
B—Asphaltum Packing.
C—Dead Air Space.
D—Outer Shell, 1 inch thick.

Cover Your Steam Pipes with

Wyckoff's
Improved
Cypress Covering

Not affected by wet and dry conditions common to steam-pipe trenches. Will not rot. Absolutely water and steam tight. Each shell is wound with extra-heavy steel wire. Coated all over with the best known preservative—**Montezuma Asphalt.**

Write for catalog

A. WYCKOFF & SON CO.
ELMIRA, N. Y.

THE HANGER FOR YOUR NEXT JOB

is the hanger that will fulfill your every demand and that is the

E-Z Radiator Hanger

STYLE R

Suitable for all wall and column radiation, is self-adjusting, is designed for vertical or horizontal alignment and require but one anchor bolt for each hanger. It is also designed to anticipate the use of temperature control valves.

IMMEDIATE SHIPMENT

HEALY-RUFF COMPANY
PLYMOUTH BUILDING
MINNEAPOLIS, MINN.

This Unit Takes the Rust Producing Power Out of Water

It is the oxygen and air dissolved in the water passing through the piping that makes the pipe corrode and rust away inside of a relatively short period of years. De-aer-ating the water makes it harmless to the piping, extending the life of the piping to that of the building itself.

The deaeration of supply water and the removing of dissolved oxygen and other gases is a practical proposition and is being accomplished by the Elliott Deaeration Process. The illustration above shows a typical Elliott Deaerator unit for building service.

An Elliott Deaerator not only extends the life of the piping to that of the building itself, eliminating the enormous cost of piping replacement, but also is able to work out of an old piping system the corrosion products contained therein.

You'll be interested in the full details

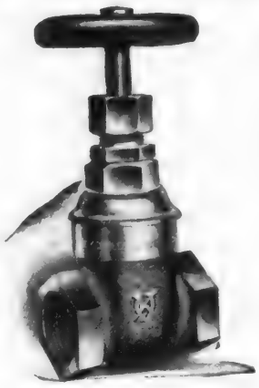
Elliott Company
Pittsburg, Pa.
General Sales Office: Fourth Street
Jeannette, Pa.

District Offices: New York, Chicago, Philadelphia, Boston, Cleveland, Cincinnati, Detroit, St. Louis, Kansas City, Baltimore, Pittsburgh, Syracuse, Atlanta

N-772

ELLIOTT
De-aer-ated water can't rust
Deaerator

KENNEDY VALVES



The Test of Valve Quality

is the length of time the valve continues to render the most efficient service without giving trouble or entailing expense. There are Kennedy Valves of the long time kind all over the United States and Canada.

These Kennedys are doing good work in every variety of valve service, and a considerable proportion of them are on high and low pressure heating system lines.

The experience of thousands of users of Kennedy Valves have given the Kennedy product a reputation for durability, reliability, and efficiency of which we are justifiably proud and that we conscientiously strive to maintain.

You can be sure that every Kennedy Valve you install will be *permanently* satisfactory in every way. The Kennedy catalog explains the details of design and construction that assure easy operation, low repair cost, negligible attendance and unusual durability. Send for a copy and use it to help make a selection of Kennedy Valves for trial.

THE KENNEDY VALVE MFG. CO.

Branch Offices and Warehouses
NEW YORK: 95 John St.
SAN FRANCISCO: 23-25 Minna St.
BOSTON: 47 India St.
CHICAGO: 228 N. Jefferson St.

MEMBERS THE NATIONAL TRADE EXTENSION BUREAU OF THE PLUMBING AND HEATING INDUSTRY. PERMIT No 70 REGISTERED

SALES OFFICES:
SEATTLE: L. C. Smith Bldg.
SALT LAKE CITY: 503 Dooley Bldg.
EL PASO: 704 Two Republics Bldg.

Made in All Patterns

Not confined to vacuum systems. Can be used on any steam system.

—Sturdiness
—Strength

These are essential qualities of this new (wheel handle) type of

Dunham PACKLESS Valve

No spring or composition disc is used to make it packless. Leakage of air into radiators of vacuum systems is absolutely prevented by the Dunham "built up" bellows construction. Steam, dirt, water cannot reach valve spindle threads.

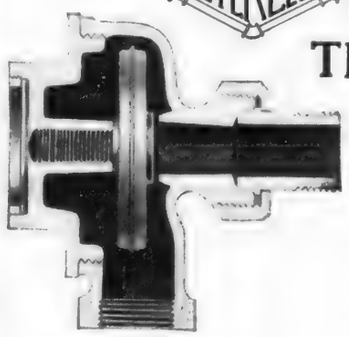
Note: Valve connection is threaded full width of union nut. Write today for other details.

C. A. DUNHAM COMPANY
230 East Ohio Street, Chicago
57 Branch and Local Sales Offices in the United States and Canada. Foreign Sales Office in London and Paris.

The DUNHAM REG. TRADE MARK HEATING SERVICE

TRADE MARK STERLING

STERLING Thermostatic Trap



100% Steam Tight
Maintains Radiators 98% Hot

These are the results of tests recently completed by the National Association of Building Owners.

Also, don't forget its other features.

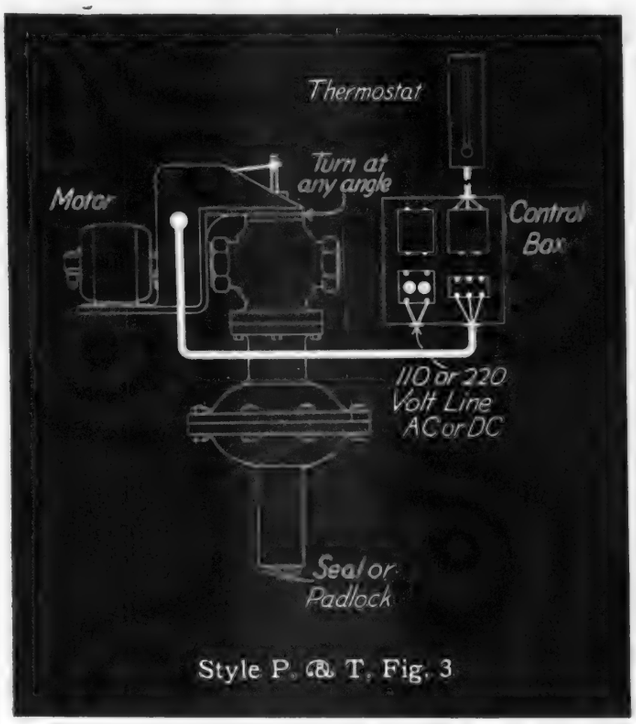
LONG LIFE

Self cleaning, which, when coupled with STERLING SERVICE insures real heating efficiency.

Write for Bulletins Nos. 31, 32 and 33 on vapor and vacuum heating and for details regarding above test

STERLING ENGINEERING COMPANY
419 Third St., Milwaukee, Wis.
Manufacturers of Vacuum and Vapor Heating Specialties

HORNUNG PRESSURE and TEMPERATURE CONTROL VALVES



Style P. & T. Fig. 3

MASTER CONTROL

The MASTER CONTROL was designed, and is especially adapted, for control of steam heat as served from a Central Heating Plant.

The MASTER CONTROL is a combination of two valves in one, in which the lower diaphragm operates to control the pressures while the motor mounted on top of the valve operates to close off the steam when no heat is required in the building

These valves are made interchangeable so that the MOTOR DRIVEN TEMPERATURE CONTROL may be attached to the PRESSURE CONTROL at any time.

The temperature control is also furnished without the pressure control diaphragm.

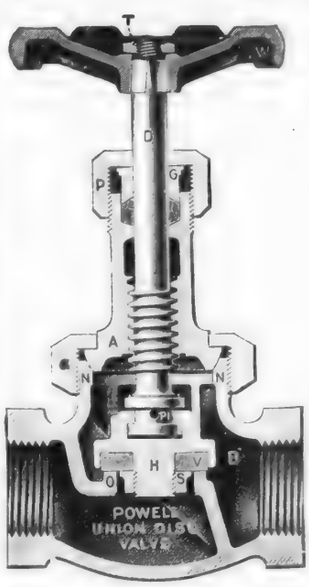
The MASTER CONTROL valve has been in use for twelve years and the saving it brings to the customer is clearly a matter of record.

A 30% reduction in the meter bill is a conservative average.

CENTRAL HEAT APPLIANCES

343 South Dearborn Street J. C. HORNUNG CHICAGO, ILL.

Powell Valves



UNION COMPOSITE DISC VALVES

ALWAYS DEPENDABLE

For Hot Water or Steam Heating

Notice the Union Bonnet Connection

Ask your dealer for Powell Valves

The Wm. Powell Company
Cincinnati, Ohio

CAPITOL PACKLESS QUICK OPENING VALVES

Have opposing seats.

Can be used on either pressure or vacuum systems.

Perfect in every detail.

CAPITOL PRODUCTS ALWAYS SATISFY.

Write for catalog and prices.

CAPITOL BRASS WORKS
Detroit, Mich.

CONDO-VAC RETURN LINE PUMP

CONDENSATION-VACUUM PUMP

A return line vacuum pump, like any other pump, is designed for efficiency and economy. A pump that is wasteful or one that is constantly in need of repair is money and time lost.

Our Condo-Vac return line pump is designed and made of such materials that it will stand up under the most distressing and unusual circumstances as well as under easy operation terms.

True efficiency in a Return Line Vacuum pump can be obtained only with a CONDO-VAC because—air and water are handled by separate pumps, each driven by its own motor and each controlled independently, eliminating the waste in electricity and wear on machinery.

Patents Pending

Each pump operates only when there is actual need of its services.

Since air and vapor are approximately four-fifths of the volume handled, there is no need of running the water pump four-fifths of the time unnecessarily. These are some of the many reasons which makes the CONDO-VAC especially desirable.

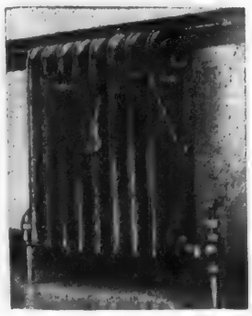
THE ABOVE ADVANTAGES OF THIS PUMP ARE BUT A FEW OF THEM. SEND FOR BULLETIN 45 AND SEE THE OTHER ADVANTAGES FOR YOURSELF.

CHICAGO PUMP COMPANY

2325 WOLFRAM STREET **CHICAGO, ILLINOIS**

HARTMANN

RADIATOR BRACKETS



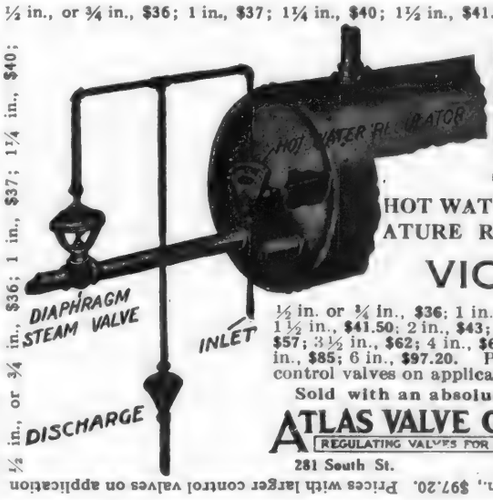
WHY?

LABOR SAVED
NO WALL STRIPS
NO BREAKAGE
NO DIRT
INEXPENSIVE

Send for descriptive circular

CHARLES HARTMANN CO.
Sheet Metal Constructors
985 Dean St., Brooklyn, N.Y.

½ in., or ¾ in., $36; 1 in., $37; 1¼ in., $40; 1½ in., $41.50; 2 in., $43; 2½ in., $47; 3 in., $57; 3½ in., $62; 4 in., $67; 4½ in., $75; 5 in., $85; 6 in., $97.20. Prices with larger control valves on application.



NET PRICES

HOT WATER TEMPERATURE REGULATOR

VICTOR

½ in. or ¾ in., $36; 1 in., $37; 1¼ in., $40; 1½ in., $41.50; 2 in., $43; 2½ in., $47; 3 in., $57; 3½ in., $62; 4 in., $67; 4½ in., $75; 5 in., $85; 6 in., $97.20. Prices with larger control valves on application.

Sold with an absolute guarantee.

ATLAS VALVE COMPANY
REGULATING VALVES FOR EVERY SERVICE
281 South St. Newark, N. J.

"Will the new be as good as the old?"

—the most Davis users ever ask

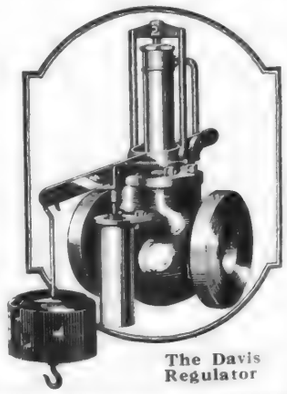
Relief Valves
Balanced Valve
Pump Governor
Flow Regulator
Float Valve
Steam Trap
Water Control Valve
Non-Return Valve
Stop and Check Valve
Water Check Valve
Pump Stop Valve
Pilot Valve
Fluid Level Controller
Emergency Stop Valve

ONCE you have installed a Davis Valve Specialty—have seen how positively and with how little attention it performs its work for such a remarkably long time—the most that you will hope for is that the next Davis device will be up to the standard of the old. It will. Share the lasting confidence of the thousands of Davis users by using—

Davis Regulators that give accurate steam pressure reduction and maintain the reduced pressure steady regardless of fluctuations in the initial pressure. They have no springs or diaphragms to cause trouble and shorten their life.

Ask the G. M. Davis Regulator Co., 436 Milwaukee Ave., Chicago, for details of this and other valve specialties listed opposite.

DAVIS VALVE SPECIALTIES
STEAM SAVERS SINCE 1875



The Davis Regulator

By Repute "Always" Reliable

Mason Reducing Valves have an extraordinary reputation for three things—long life, continuous service and reliability, which is, after all, only a natural tribute earned through merit.

MASON REDUCING VALVES

are made in many types and sizes, and every type and every size can be depended upon to reduce and maintain pressure at the proper delivery point, regardless of the fluctuation in the initial pressure.

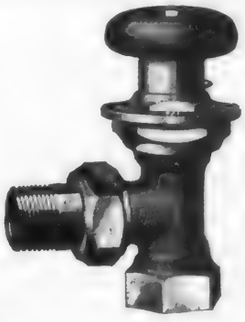
To make your assurance doubly sure, Mason service is never separated from Mason products.

If pressure regulation problems trouble you, make use of our service.

MASON REGULATOR COMPANY

Boston, Mass. San Francisco, Cal. Montreal, Canada

You Can Save More Steam— Fuel— Money with the



PACKLESS

Adsco Graduated Radiator Valve

Closest Graduation.
Full Nickel Plated.
Plain Nickel Letters on Black Dial.
Non-rising stem; always free-moving; always steam-tight.
Removable insert—Valve fits any size radiator, 20 to 200 sq. ft.
Sold to heating contractors on merchandise basis at uniform price.
Write for special folder.

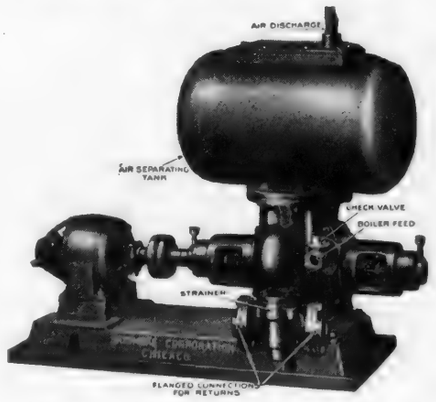
Ask about Adsco Heating of building groups from Central Station Steam Plant—Bulletin No. 20-H; for individual buildings, Bulletin No. 158-H.

AMERICAN DISTRICT STEAM COMPANY

GENERAL OFFICES AND WORKS
NORTH TONAWANDA, N.Y.
OFFICES
New York Chicago Seattle Pittsburgh St. Paul

ADSCO HEATING

SKIDMORE HYDRO TURBINE VACUUM AND BOILER FEED PUMP



Set Them as They Come

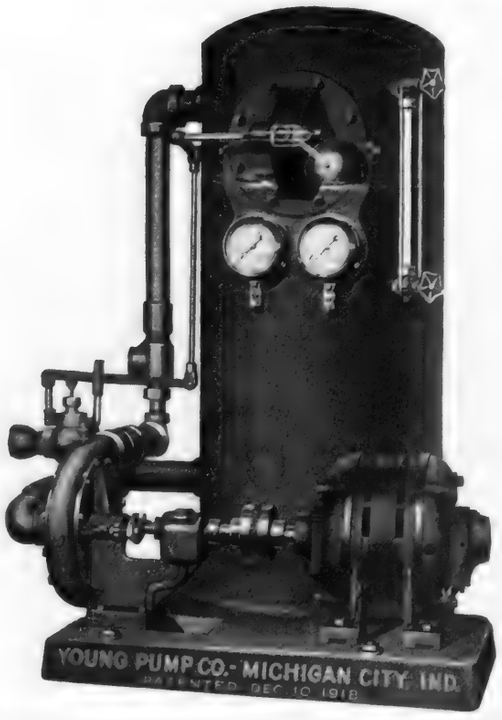
Connect up returns, wire motor and run.
Constant efficiency.
Simple design.
Low power consumption.
Bronze fitted throughout.
Minimum floor space.
Large capacity.
Return connections are close to floor.
No loss of feed water due to over flowing.
Only one moving part.
Shaft carried on heavy ball bearings.
A self contained unit all on one base.
The newest and simplest device for use on a vacuum heating system.
As there are no close clearances, this pump will maintain its original high efficiency indefinitely.

Write for Bulletin No. 1

Built in five sizes for 10 and 20 lbs. pressure, to handle 8000, 16000, 26000, 40000, and 65000 sq. ft. of radiation, for continuous service or with automatic control.

SKIDMORE CORPORATION

General Offices and Factory
1535 Dayton St. CHICAGO, U. S. A.



They Come This Way!

JUST as you see the "YVM" outfit in the above illustration—that is the way the Young Centrifugal Vacuum and Boiler Feed Outfits are shipped. *Complete in every detail!* When received on the job, it is only necessary to make pipe connection to the system and boiler and wire connection to the motor. Then all is ready for operation.

The "YVM" is the simplest outfit made. There are no valves, springs or other parts that require adjustment, wear out or cause repair expense. It has a very low maintenance cost—in fact, the outfit is *economical in every way*.

Made in six sizes to handle 4,000, 8,000, 16,000, 26,000, 40,000 or 65,000 sq. ft. of radiation; for continuous operation or automatic control, to meet any condition or pressure.

Young Pump Company

Michigan City **Indiana**

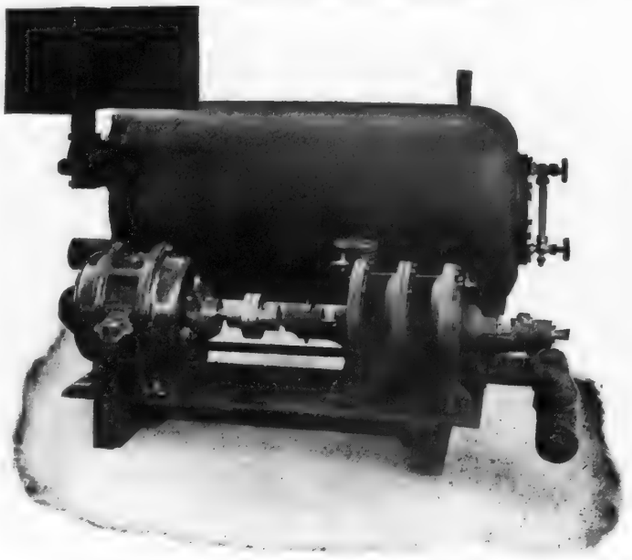
Chicago Office, 327 S. Lasalle St

YEOMANS

ELECTRICALLY OPERATED

CONDENSATION RETURN PUMPS

HORIZONTAL AND VERTICAL



SPECIAL TYPE H HIGH PRESSURE UNIT

RUGGED **RELIABLE**

Constructed to insure long life.

Superiority proven by years of experience.

Send for Bulletin C-5100

YEOMANS BROTHERS CO., 1421 Dayton St., Chicago, Ill.

Canadian Representatives Darling Bros., Ltd., Montreal

AIR CONDITIONING TRADE MARK

APPARATUS for maintaining artificial atmospheric conditions in industrial plants.

ATMOSPHERIC CONDITIONING CORPORATION

LAFAYETTE BLDG.
PHILADELPHIA

Ross

Surface Barometric and Jet Condensing Equipments for Power Plants.
Main, Auxiliary, Distilling Condensers & Evaporators for Marine Service.
Distilling Condensers for Refrigeration and Chemical Plants.

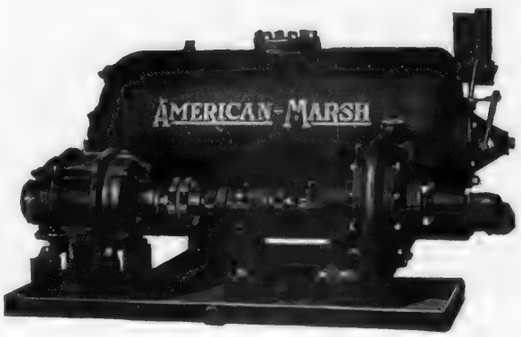
Crosshead Guided" Expansion Joints
Ross Boiler Feed Water Heaters.
Ross Oil and Sugar Juice Heaters.
Gravity & Forced Circulation Heaters.
Ross Oil, Air and Water Coolers.

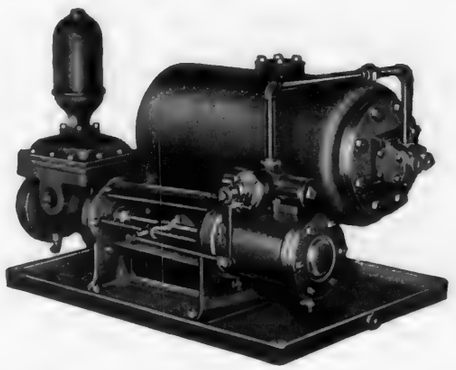
ROSS HEATER & MFG. CO., Buffalo, N. Y.

THE BRAND THAT LEADING ENGINEERS DEMAND

American-Marsh Condensation Pumps

Direct Acting and Centrifugal





American-Marsh Condensation Pumps are the result of over thirty-five years experience in the manufacture of high grade pumps for heating systems. They are built in the motor driven centrifugal type in both horizontal and vertical patterns, the vertical type being intended for use where the returns are laid on or under the basement floor.

The steam driven pattern is equipped with the well known American-Marsh steam valve, the same as used on American-Marsh Vacuum Pumps. With this type of valve the pump positively cannot short-stroke or race. Steam pumps can be furnished to operate on steam pressures as low as 10 pounds. On pressures lower than this the motor driven type is recommended.

May we send you our interesting booklet covering pumps for heating systems?

AMERICAN STEAM PUMP COMPANY, Battle Creek, Mich.

Full Complement of Building Pumping Units

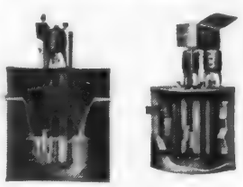
Automatic, Centrifugal, Vacuum and Boiler Feed Pumps

Fig. 2234

Capacities, 2500 to 65000 square feet direct radiation per standard single units.

Self Contained
High Class—Dependable

Cellar Drainers, Bilge and Sump Pumps, Sewage Ejectors



Duplex Single

Capacities, 7 to 3000 gallons per minute.

Duplex Units, Double Capacity

Made in several types and specially designed to meet all conditions.

Automatic Condensation Pumps and Receivers

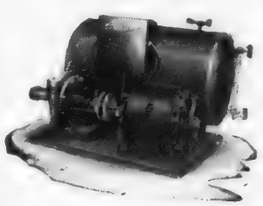
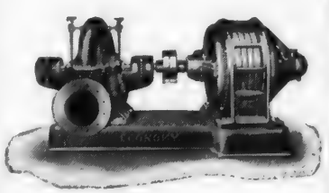


Fig. 2176

Capacities, 1000 to 125000 square feet

Made in following types: Horizontal, Vertical, and Underground. Also Piston types for extreme pressures.

Centrifugal Pumps for all purposes



Made either Single or Multi-stage

Boiler Feed house device. Hot water heating and Ice water circulating pumps.

All capacities and pressure from 5 to 5000 gallons per unit.

PERFORMANCE GUARANTEES

ECONOMY PUMPING MACHINERY CO.

122-124 N. Curtis St. Chicago, Illinois.

ENGINEERS' SPECIFICATION INDEX

AIR COMPRESSORS.
Nash Engineering Co., So. Norwalk, Conn.

AIR CONDITIONING APPARATUS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corporation, Philadelphia, Pa.
Buckeye Blower Co., Columbus, O.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
L. J. Wing Mfg. Co., New York.

AIR COOLING AND DRYING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Cooling Tower, Inc., New York.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Seymour, Jas. M., Newark, N. J.
L. J. Wing Mfg. Co., New York.

AIR ELIMINATORS.
Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.

AIR SEPARATORS.
Griscom-Russell Co., New York.
Hoffman Specialty Co., New York.

AIR WASHERS.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila, Pa.
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporation, New York.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

AUTOMATIC SPRINKLERS
Grinnell Co., Inc., Providence, R. I.

BLOWERS.
Fan.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Porbeck Mfg. Co., St. Louis, Mo.
Skinner Bros. Mfg. Co., St. Louis, Mo.
L. J. Wing Mfg. Co., New York.

Pressure.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
L. J. Wing Mfg. Co., New York.

Rotary.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg Co., New York.

Turbine.
L. J. Wing Mfg. Co., New York.

BOILER BREECHINGS.
Hartmann Co., Charles, Brooklyn, N. Y.

BOILER CEMENT
Shur Tite Mfg. Co., Norwood, Cincinnati, O.

BOILERS.
Copper.
Dahlquist Mfg. Co., Boston, Mass.

Down-Draft.
American Radiator Co., Chicago, Ill.
The Brownell Co., Dayton, O.
Chicago Down Draft Furnace Co., Chicago, Ill.
Hart & Crouse Co., Utica, N. Y.
Herbert Boiler Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Co., Kewanee, Ill.

Heating.
Advance Boiler Corp., New York.
American Radiator Co., Chicago, Ill.
Brownell Co., The, Dayton, O.
Gorton & Lidgerwood Co., New York.
Gurney Heater Mfg. Co., Boston, Mass.
Herbert Boiler Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Works Co., Titusville, Pa.
Utica Heater Co., Utica N. Y.

Oil Burning
Breese Engineering, Inc., Chicago, Ill.

Power.
Kewanee Boiler Co., Kewanee, Ill.
Oil City Boiler Works, Oil City, Pa.
Titusville Iron Works Co., Titusville, Pa.

CALORIMETERS.
Sarco Co., New York.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.

COILS, PIPE.
Buckeye Blower Co., Columbus, O.
Simmons Co., John, New York.

Air.
New York Blower Co., Chicago, Ill.

COOLERS.
Oil.
Griscom-Russell Co., New York.

COOLING TOWERS.
Badger & Sons Co., E. B., Boston, Mass.
Cooling Tower Co., Inc., New York.

CONDENSERS.
Alberger Pump & Condenser Co., New York.
American Radiator Co., Chicago, Ill.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

CONVERTERS, HOT WATER.
Patterson-Kelley Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

COVERING, PIPE.
America District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son Co., A., Elmira, N. Y.

DAMPERS, DUCT.
American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.

DEHUMIDIFYING APPARATUS.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
New York Blower Co., Chicago, Ill.

DISTILLERS, (water).
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.

DRYING SYSTEMS.
(See Air Cooling and Drying Systems.)

DUST COLLECTING SYSTEMS.
American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, New York.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Brothers Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.

DUST COLLECTORS.
Atmospheric Conditioning Corp., Phila., Pa.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Brothers Co., Allentown, Pa.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

DUST DETERMINATORS.
Atmospheric Conditioning Corp., Phila., Pa.

EQUALIZING LOOPS.
Hoffman Specialty Co., New York.

EXHAUST SYSTEMS.
Buckeye Blower Co., Columbus, O.
Hartmann Co., Charles, Brooklyn, N. Y.

ENGINES.
Steam, Automatic.
American Blower Co., Detroit, Mich.
The Brownell Co., Dayton, O.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam, High Speed.
American Blower Co., Detroit, Mich.
Clarage Fan Co., Kalamazoo, Mich.
New York Blower Co., Chicago, Ill.

EVAPORATORS.
Boiler Feed Make-up.
Badger & Sons Co., E. B., Boston, Mass.
Griscom-Russell Co., New York.

EXHAUST HEADS.
Burt Mfg. Co., Akron, O.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley, Co., New York.
Simmons, Co., John, New York.
Wright-Austin Co., Detroit, Mich.

EXPANSION JOINTS.
Alberger Pump & Condenser Co., New York.
American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Ric-Wil Co., Cleveland, O.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Webster & Co., Warren, Camden, N. J.

FANS, EXHAUST.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo, Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Seymour, Jas. M., Newark, N. J.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

FILTERS, (Aerating).
Griscom-Russell Co., New York.

Feed-water.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.

FITTINGS, FLANGED.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
Simmons Co., John, New York.

FLANGES.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., N. Y.

FUEL OIL BURNERS.
Breese Engineering Inc., Chicago, Ill.
Combustion Co., Chicago, Ill.

FURNACES, WARM AIR.
Twin Fire Furnace Co., Chicago, Ill.

GASKETS, METALLIC.
Sarco Co., New York.

GAUGE BOARDS.
Bishop & Babcock Co., Cleveland, O.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

GAUGES.
Draft.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.

Hydraulic.
Jas. P. Marsh & Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.

Ounce Graduated.
Jas. P. Marsh & Co., Chicago, Ill.
O-E Specialty Co., Milwaukee, Wis.

Pressure.
American Dist. Steam Co., North Tonawanda, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

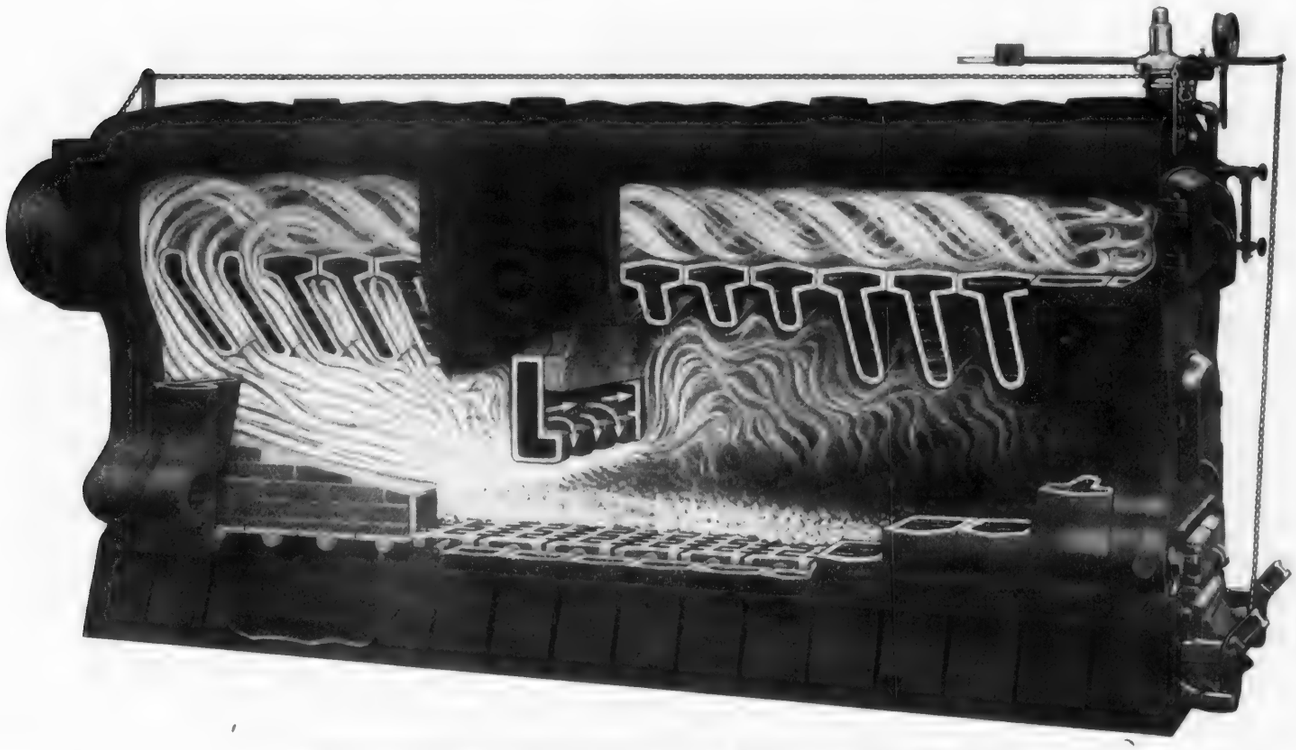
Vacuum.
Bishop & Babcock Co., Cleveland, O.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Webster & Co., Warren, Camden, N. J.

Water.
American District Steam Co., No. Tonawanda, N. Y.
Capitol Brass Works, Detroit, Mich.
Detroit Lubricator Co., Detroit, Mich.
Jenkins Bros., New York.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.

GENERATOR COOLING SYSTEMS.
Atmospheric Conditioning Corp., Phila., Pa.
Cooling Tower, Inc., New York.

GENERATORS, (Heat)
Honeywell Heating Specialties Co., Wabash, Ind.

GOVERNORS, (pump).
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Wright-Austin Co., Detroit, Mich.



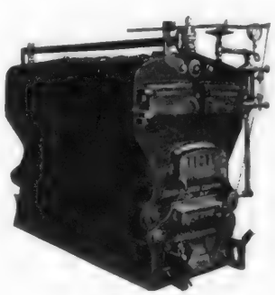
SUPER-SMOKELESS BOILER SHOWING AIR INTAKE AND FIRE TRAVEL

UTICA-IMPERIAL
Super-Smokeless Boilers
WILL BURN ANY AVAILABLE GRADE OF CHEAP SOFT COAL

YOU'LL find these smokeless boilers in important buildings all over the country, burning soft and hard coal of every grade. They utilize all the fuel, consuming it at a high temperature, neither collecting soot inside nor letting it out in the form of smoke. This means real heating efficiency and fuel economy.

The Bunsen Burner Principle of letting air into the base of the flame accounts for this remarkable combustion. The gases generated from the coal mix with a large volume of air, right at the heart of the fire. The result is an intensely hot, swirling, blue flame that travels twice through the boiler, heating every inch of surface as it goes.

Utica-Imperial SUPER-SMOKELESS Boilers burn any available fuel. Their single grate assures simplicity of operation; and their long firing periods mean a mimimum of attention. They are constructed in sections to permit of easy handling, convenience in shipment, and installation in completed buildings.



Recommended by foremost architects
Installed by leading heating contractors
Vouched for by numerous satisfied users

Write for Complete Catalog and List of Installations

UTICA HEATER COMPANY, UTICA, N. Y.

218-220 West Kinzie Street, Chicago, Ill. | 707 Union Building, Cleveland, O. | 5620 Grand Central Terminal, New York, N. Y.

SALES OFFICES IN 32 PRINCIPAL JOBBING CENTERS

ENGINEERS' SPECIFICATION INDEX (Continued)

HEATERS.

(Domestic Water.)

American District Steam Co., No. Tonawanda, N. Y.
American Radiator Co., Chicago, Ill.
Dahlquist Mfg. Co., Boston, Mass.
Excelso Specialty Works, Buffalo, N. Y.
Grinnell Co., Inc., Providence, R. I.
Griscom-Russell Co., New York.
Hotstream Heater Co., Cleveland, Ohio.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

Feed Water, (Closed).

Alberger Pump & Condenser Co., New York.
Griscom-Russell Co., New York.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Simmons Co., John, New York.
Sims Co., Erie, Pa.
Whitlock Coil Pipe Co., Hartford, Can.

Feed Water, (Open).

Griscom-Russell Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren. Camden, N. J.

Fuel-oil.

Griscom-Russell Co., New York.
American Blower Co., Detroit, Michigan.

Pipe, Coil (Air).

American Blower Co., Detroit, Mich.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

Portable Unit Air.

American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
L. J. Wing Mfg. Co., New York.

HEATING SYSTEMS.

Vacuum.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
O. E. Specialty Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

Vapor.

American District Steam Co., No. Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

HUMIDIFIERS.

American Blower Co., Detroit, Mich.
American Moistening Co., Boston, Mass.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, Newark, N. J.
Grinnell Co., Inc., Providence, R. I.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
Seymour, Jas. M., Newark, N. J.

HUMIDITY CONTROL.

Atlas Valve Co., Newark, N. J.
American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Carrier Engineering Corporation, New York.
Grinnell Co., Inc., Providence, R. I.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.

HYDROMETERS.

Jas. P. Marsh & Co., Chicago, Ill.

INSTRUMENTS.

Electric Measuring.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Indicating and Recording.

Bailey Meter Co., Cleveland, O.
Jas. P. Marsh & Co., Chicago, Ill.
Sarco Co., New York.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Standard Thermometer Co., Boston, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

INSULATING MATERIALS.

American District Steam Co., No. Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Hornung, J. C., Chicago, Ill.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Sons, A., Elmira, N. Y.

MANOMETERS.

Schaeffer & Budenberg Mfg. Co. and American Steam Gauge and Valve Mfg. Co., Division, Brooklyn, N. Y.

MECHANICAL DRAFT APPARATUS.

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Clarage Fan Co., Kalamazoo, Mich.
Massachusetts Blower Co., Watertown, Mass.
New York Blower Co., Chicago, Ill.
L. J. Wing Co., New York.

METERS.

Condensation.

American Dist. Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.

Feed Water.

Simmons Co., John, 110 Center St., New York.
Feed Water (Wier Type).
Webster & Co., Warren, Camden, N. J.

Pitot Tube.

American Blower Co., Detroit, Mich.
Schaeffer & Budenberg Mfg. Co., Brooklyn, N. Y.

Steam.

American District Steam Co., No. Tonawanda, N. Y.
Bailey Meter Co., Cleveland, O.

MOTORS, (Electric).

Sprague Electric Works, New York
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PAINT, FOR HEATED SURFACES.

Ric-Wil Co., Cleveland. O.

PIPE.

Soil.

Simmons Co., John, 110 Center St., New York.

Steel.

Simmons Co., John, 110 Center St., New York.

Wrought Iron

Simmons Co., John, 110 Center St., New York.

Wood.

Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE BENDING.

Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
National Pipe Bending Co., New Haven, Conn.
Simmons Co., John, 110 Center St., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

PIPE CASING, WOOD.

American District Steam Co., No. Tonawanda, N. Y.
Wyckoff & Sons Co., A., Elmira, N. Y.

PIPE HANGERS.

Grinnell Co., Inc., Providence, R. I.
Jenkins Bros., New York.
Simmons Co., John, New York.

PIPE CUTTING AND THREADING MACHINES.

Crane Co., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.

PIPE, POWER.

Crane Co., Chicago, Ill.
Grinnell Co., Inc., Providence, R. I.
Simmons Co., John, New York.

POWER PLANT SUPPLIES.

American District Steam Co., No. Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Crane Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

PUMPS.

Centrifugal.

Alberger Pump & Condenser Co., New York.
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Sprague Electric Works, New York.
Yeomans Bros. Co., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

Condensation.

American Steam Pump Co., Battle Creek, Mich.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Thompson Mfg. Co., Des Moines, Ia.
Trane Co., La Crosse, Wis.
Western Engineering Co., Davenport, Iowa.
Wright-Austin Co., Detroit, Mich.
Yeomans Bros. Co., Chicago, Ill.

Rotary.

Nash Engineering Co., So. Norwalk, Conn.
Thompson Mfg. Co., Des Moines, Ia.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

Steam.

American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.

Turbine.

Alberger Pump & Condenser Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Nash Engineering Co., So. Norwalk, Conn.
Yeomans Bros., Chicago, Ill.

Vacuum.

American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Co., Cleveland, O.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Hydro-High Vacuum Pump Co., Newport, Ky.
McAlear Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago. Ill.
Trane Co., La Crosse, Wis.
Union Steam Pump Co., Battle Creek, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Yeomans Bros., Chicago, Ill.
Young Pump Co., Michigan City, Ind.

PYROMETERS.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

RADIATOR HANGERS.

Gloeckle, Jr., A. F., Rochester, N. Y.
Hartmann Co., Chas., Brooklyn, N. Y.
Healy-Ruff Co., Minneapolis, Minn.

RADIATORS, STEAM AND WATER.

American Radiator Co., Chicago, Ill.
International Heater Co., Utica, N. Y.
Gurney Heater Mfg. Co., Boston, Mass.
Simmons Co., John, New York.

RECEIVERS.

Air.

American District Steam Co., No. Tonawanda, N. Y.
The Brownell Co., Dayton, O.
Sterling Engineering Co., Milwaukee, Wis.

Condensation.

Chicago Pump Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Yeomans Bros., Chicago, Ill.

REGULATORS.

Boiler-Feed.

McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Wright-Austin Co., Detroit, Mich.

Damper.

American Dist. Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
American Radiator Co., Chicago, Ill.
Bishop & Babcock Co., Cleveland, O.
Davis Regulator Co., G. M., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
L. J. Wing Mfg. Co., New York.

Pressure.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
McAlear Mfg., Chicago, Ill.
National Regulator Co., Chicago, Ill.

Temperature.

American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.

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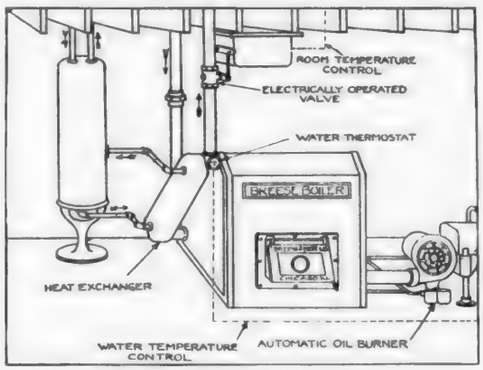

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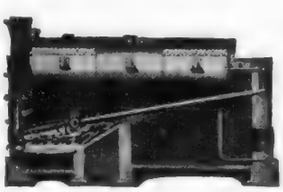

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Elliott Co., Jeanette, Pa.
Hornung, J. C., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

SEPARATORS.

OIL.

Burt Mfg. Co., Akron, Ohio.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Wright-Austin Co., Detroit, Mich.

STEAM.

American District Steam Co., No. Tonawanda, N. Y.
Bishop & Babcock Co., Cleveland, O.
Crane Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sims Co., Erie, Pa.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

SHEET METAL CONSTRUCTION.

Hartmann Co., Charles. Brooklyn, N. Y.

SPRAY COOLING SYSTEMS.

Atmospheric Conditioning Corp., Phila., Pa.
Cooling Tower Co., Inc., New York
Massachusetts Blower Co., Watertown, Mass.
Seymour, Jas. M., Newark, N. J.

STRAINERS.

OIL

Burt Mfg. Co., Akron, Ohio.
Elliott Co., Jeanette, Pa.
Griscom-Russell Co., New York.

STEAM.

American Dist. Steam Co., No. Tonawanda, N. Y
Elliott Co., Jeanette, Pa.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., New York.
Wright-Austin Co., Detroit. Mich.

THERMOMETERS.

(Recording and Indicating.)

Sarco Co., New York.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Standard Thermometer Co., Boston, Mass.

WATER.

Marsh & Co., Jas. P., Chicago, Ill.

THERMOSTATS.

American Radiator Co., Chicago, Ill.
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Co., Cleveland, O.
Johnson Service Co., Milwaukee, Wis.
Powers Regulator Co., Chicago, Ill.
Sarco Co., New York.

TRAPS.

RADIATOR.

Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, O.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
H. W. Nelson Co., Moline, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.

RETURN.

American Blower Co., Detroit, Mich.
Dunham Co., C. A., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jas. P. Marsh & Co., Chicago, Ill.
Mouat-Squires Co., Cleveland, O.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., La Crosse, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

STEAM.

American Blower Co., Detroit, Mich.
American District Steam Co., No. Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Patterson-Kelley Co., New York.
Sarco Co., New York.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Simmons Co., John, New York.
Trane Co., La Crosse Wis.
Wright-Austin Co., Detroit, Mich.

VACUUM.

American Blower Co., Detroit, Mich.
Bishop & Babcock Co., Cleveland, O.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Sarco Co., New York.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.
Wright-Austin Co., Detroit, Mich.

TURBINES, (Steam).

Buffalo Forge Co., Buffalo, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
L. J. Wing Mfg. Co., New York.

TURBO-BLOWERS.

Westinghoue Electric & Mfg. Co., East Pittsburgh, Pa.

UNDERGROUND PIPE CONDUITS.

American District Steam Co., No. Tonawanda, N. Y.
Hornung, J. C., Chicago, Ill.
National Asbestos Mfg. Co., Jersey City, N. J.
Ric-Wil Co., Cleveland, O.
Wyckoff & Son., A., Elmira, N. Y.

VACUUM CLEANING APPARATUS.

American Radiator Co., Chicago, Ill.
Spencer Turbine Co., Hartford, Conn.

VALVES.

AIR (Automatic)

American Radiator Co., Chicago, Ill.
Commonwealth Brass Corporation, Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Wm. S. Haines & Co., Philadelphia, Pa.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Hoffman Specialty Co., New York.
O-E Specialty Mfg. Co., Milwaukee, Wis.
Simmons Co., John, New York.

AIR RELIEF.

American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.
Leskole Air Valve Co., New York.
McAlear Mfg. Co., Chicago, Ill.
The Wm. Powell Co., Cincinnati, O.
Sterling Engineering Co., Milwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

BACK PRESSURE.

Crane Co., Chicago, Ill.
Griscom-Russell Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
Simmons Co., John, New York.

BALANCED.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.

BLOW-OFF.

Crane Co., Chicago, Ill.
Elliott Co., Jeanette, Pa.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

CHECK.

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg Co., Elmira, N. Y.
O-E Specialty Mfg. Co., Milwaukee, Wis.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

GATE.

American District Steam Co., No. Tonawanda, N. Y.
Capital Brass Works, Detroit, Mich.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

GLOBE, ANGLE AND CROSS.

Commonwealth Brass Corp., Detroit, Mich.
Crane Co., Chicago, Ill.
Dole Valve Co., Chicago, Ill.
Illinois Engineeringe Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Erie, Pa.
The Wm. Powell Co., Cincinnati, O.
Simmons Co., John, New York.

HYDRAULIC-OPERATING.

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.

NON-RETURN.

Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
The Wm. Powell Co., Cincinnati, O.
Schaeffer & Budenberg Mfg. Co. and American Steam Gauge & Valve Mfg. Co., Division, Brooklyn, N. Y.
Simmons Co., John, New York.

RADIATOR.

American Radiator Co., Chicago, Ill.
American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Co., Cleveland, O.
Capitol Brass Works, Detroit, Mich.
Commonwealth Brass Corporation, Detroit, Mich.
Crane Co., Chicago, Ill.
Detroit Lubricator Co., Detroit, Mich.
Dole Valve Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Gorton & Lidgerwood Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Marsh Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
The Wm. Powell Co., Cincinnati, O.
Trane Co., La Crosse, Wis.
Simmons Co., John, New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Pa.
Sterling Engineering Co., Wilwaukee, Wis.
Webster & Co., Warren, Camden, N. J.

REDUCING.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Mason Regulator Co., Boston, Mass.
The Wm. Powell Co., Cincinnati, O.
Powers Regulator Co., Chicago, Ill.

REGULATING.

American District Steam Co., No. Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
McAlear Mfg. Co., Chicago, Ill.
The Wm. Powell Co., Cincinnati, O.

SAFETY.

American District Steam Co., No. Tonawanda, N. Y.
Jenkins Bros., New York.
The Wm. Powell Co., Cincinnati, O.
Schaeffer & Budenberg Mfg. Co. and American Brooklyn, N. Y.

STOP AND CHECK (See Valves, Non-Return.)

VENTILATING HEATERS.

American Blower Co., Detroit, Mich.
American Radiator Co., Chicago, Ill.
Bayley Mfg. Co., Milwaukee, Wis.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Seymour, Jas. M., Newark, N. J.
Massachusetts Blower Co., Watertown, Mass.

VENTILATING SYSTEMS.

American Blower Co., Detroit, Mich.
Atmospheric Conditioning Corp., Phila., Pa.
Autovent Fan & Blower Co., Chicago, Ill.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corporatjon, Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Garden City Fan Co., Chicago, Ill.
Hersh Bros. Co., Allentown, Pa.
Ilg Electric Ventilating Co., Chicago, Ill.
Massachusetts Blower Co., Watertown, Mass.
H. W. Nelson Co., Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilating Co., New York.
Porbeck Mfg. Co., St. Louis, Mo.
Seymour, Jas. M., Newark, N. J.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sprague Electric Works, New York.
L. J. Wing Mfg. Co., New York.

VENTILATORS.

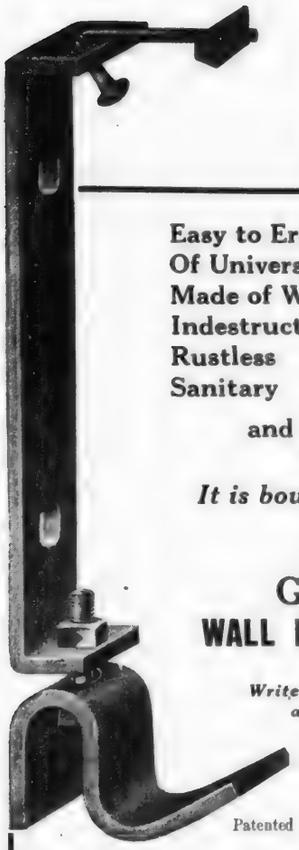
Allen Air-Turbine Ventilator Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Burt Mfg. Co., Akron, Ohio.
Hersh Bros. Co., Allentown, Pa.
New York Blower Co., Chicago, Ill.
Seymour, Jas. M., Newark, N. J.
L. J. Wing Mfg. Co., New York.

MUSHROOM.

Hersh Brothers Co., Allentown, Pa.
Knowles Mushroom Ventilator Co., New York.
New York Blower Co., Chicago, Ill.

PORTABLE UNIT FANS.

(See Heater Portable Unit Air)



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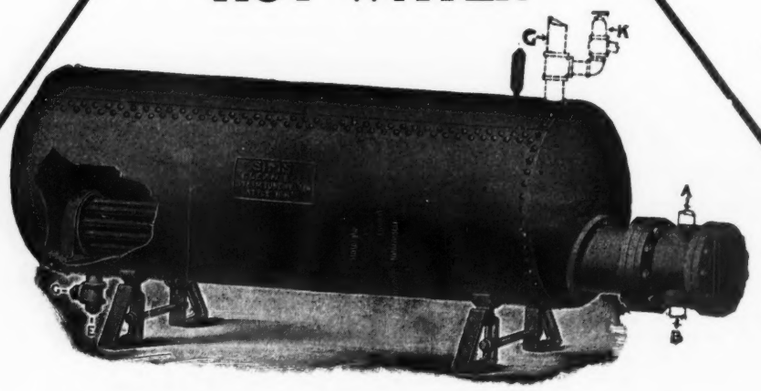

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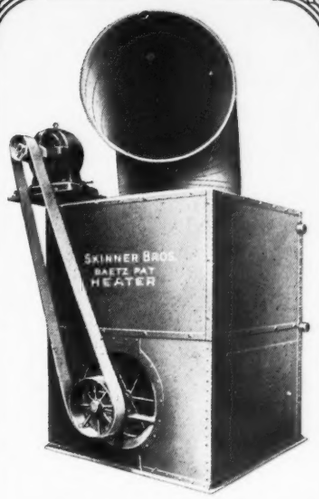

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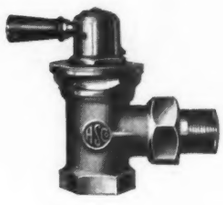

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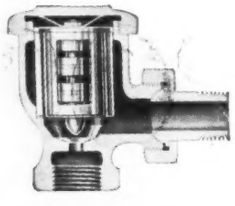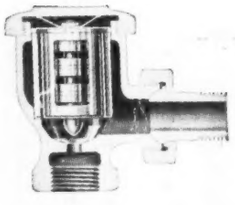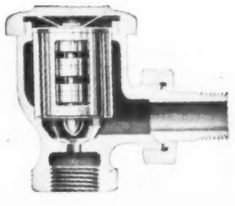
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